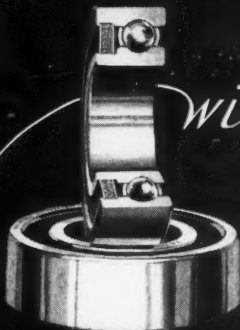


MODERN Machine Shop

July, 1932

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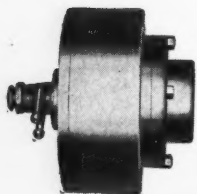
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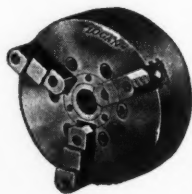
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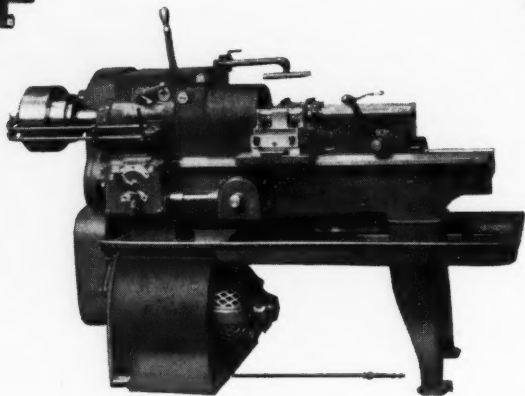


At left—Logan Rotating Cylinder.



At right—Logan Chuck . . . all types.

Below—LeBlond Special Automatic Lathe with Logan equipment.



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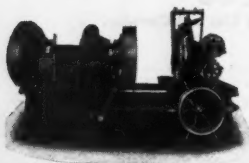
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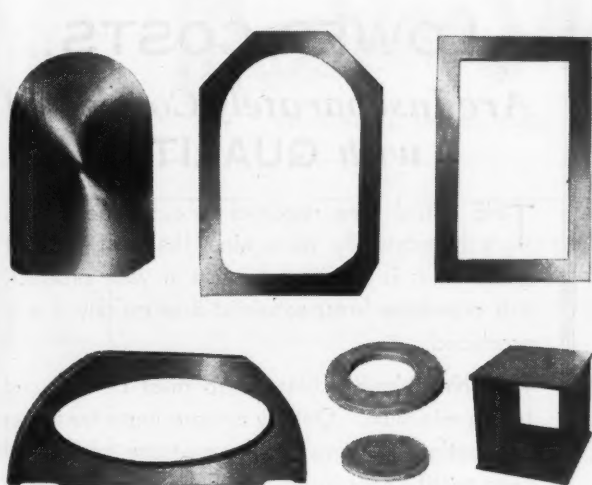


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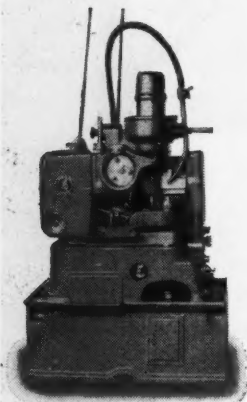
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MODERN Machine Shop

HOWARD CAMPBELL, Editor

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JULY, 1932

Number 2

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MODERN Machine Shop

CINCINNATI, OHIO

JULY, 1932

VOL. 5, No. 2

The Essentials of Hardening Simple Tools and Parts

*An Outline of Methods to be Followed in the Hardening
and Tempering of Small High Speed and Carbon
Steel Sections*

By **FREDERICK T. POTTER**

President, Stark Tool Company, Waltham, Mass.

IN any discussion of heat treating it must be borne in mind that, due to the endless variety of sizes, shapes, and materials to be treated, there are an almost equal number of opinions as to the best methods to be used—many of which are sound and produce excellent results. We shall, therefore, consider only the essential elements of hardening and drawing, leaving variations to the experience of the operator.

Of all the phases of metal working, heat treatment appears to be one of the most neglected, particularly among the smaller shops where the "rule of thumb" methods still seem, in many cases, to be considered satisfactory. As used by many experienced operators they are, but in most cases lack of uniformity and spoiled work are the all too frequent results. In this article we shall endeavor to show that high grade work may be turned out consistently with a minimum of technical knowledge and

without extremely elaborate or expensive equipment.

The Furnace—For such work as small tools and dies, where injury to the surface must be avoided and dimensions must be maintained, heating indirectly or by radiant heat is very desirable. This method involves the use of a furnace having a chamber or muffle, around the outside of which the products of combustion pass, where gas or oil is used as fuel, or around the outside of which the heating elements are placed if an electric furnace is used. The muffle is made of refractory material and may be sealed, open at one end, or open at both ends, depending upon the job.

The muffle prevents the flame from coming in direct contact with the work and in itself will eliminate a large part of the surface deterioration or oxidation which takes place when the work is put directly into the flame. For carbon steels, a muffle made of any one of several types of

clays will work satisfactorily, but for high speed temperatures a silicon carbide muffle is far more durable, gives better distribution of heat due to better conductivity, and lessens the danger of muffle breakage as a result of rapid heating.

With this type of furnace some method by which the atmosphere in the muffle may be controlled is desir-



Stark "Electroblast" High Speed Muffle Furnace.

able. In the ideal neutral atmosphere there is an excess of neither air nor of gas; thus work that is treated in this atmosphere has neither perceptible scale (oxidation) nor soft surface (decarburization). In the modern gas or electric furnace, a neutral atmosphere is preserved by throwing a separate sheet of gas flame across the door or muffle opening, completely covering the opening. A neutral atmosphere may also be obtained by using an auxiliary muffle lining consisting of carbonaceous material which gives off carbon monoxide when heated to high speed temperatures.

In the furnace shown in the illustration, approximately the same result is obtained by allowing the

burned gases to pass out of the combustion chamber through an exhaust opening located in front of the open end of the muffle. These hot gases burn up any oxygen entering from the door and form an atmosphere in the muffle containing a large percentage of carbon monoxide, thus producing the desired neutral condition of atmosphere and resulting in very high grade work.

In an atmosphere which contains as little as 12 per cent of carbon monoxide, scaling and surface burning will result on the work, particularly in the case of high speed steel. At 17 per cent the finish will be good but decarburization or soft surface may be expected. At from 25 to 30 per cent, however, the work will be clean and thoroughly hard. Determination of the proportion of carbon monoxide is difficult without proper instruments, but approximate results may be obtained by noting the characteristic appearance of the flame. In electric furnaces with separate gas curtains, using average illuminating gas for the curtain, the flame should appear somewhat reddish with a scarcely transparent atmosphere. In the furnace shown in the illustration, where the burned gases are used to form the curtain, there should be a slight excess of gas, denoted by a distinct flame issuing from the vent.

Pyrometer Equipment—While satisfactory results may be obtained when the proper temperature is determined by eye, it requires an experienced operator. And since conditions of light vary greatly in hardening rooms, making accurate comparisons of color difficult and forcing dependence entirely upon judgment, this method is not advisable for consistently good work. Various types of instruments ranging from portable thermo-electric and optical pyrometers to expensive recording and automatic

control instruments are available for this purpose. There is a type for every requirement, ranging in price from \$35 to many hundreds. They are well worth the investment, and are used by all up-to-date heat treating plants and departments.

Procedure—In treating high speed tools of the usual 18 per cent tungsten content, such as Rex AA, a preheat at about 1600 deg. F. is necessary until the piece is thoroughly heated. The preheating may be done in a separate furnace or compartment, or in the front of the high heat furnace if there is a space where approximately this temperature is maintained. The length of time for which the work is held at this heat is not critical. After the preheat, the work should be put into the high heat chamber and brought rapidly to from 2250 to 2450 deg. F., the higher temperature being used for heavy tools and the lower for those of thin section. The type of steel used has some bearing on the temperature to be used.

In many cases it is advisable to suspend the work in the center of the chamber. It should be left in the furnace—which is maintained at the predetermined heat—and watched until it reaches approximately the same temperature as the thermocouple projection and then should be immediately quenched. A pair of colored glasses will assist in judging the proper heat and will save considerable eye strain.

On pieces where grinding after hardening is impossible or undesirable, the piece must be removed just before it starts to sweat or bubble. Lathe and planer tools on which a fine finish is not necessary will give better results if allowed to sweat slightly. The exact point is a matter of judgment, but it is not difficult to learn. It is generally conceded that an undesirable coarsening of grain

will result if the work be left in the high heat longer than is necessary to bring it to the proper temperature. In a perfectly neutral atmosphere this tendency to grain growth is lessened.

The Quench—High speed steel may be quenched in a cold air blast or in oil, but in the former case a heavy scale is usually formed which, in many cases, is objectionable. The air quench is used only when very delicate tools are likely to crack under the more rapid quench of the oil. There are many opinions as to the properties of various quenching mediums, including glycerine, fish oil, compounded mineral oil, or pure mineral oil. However, for several reasons pure mineral oil seems to be the most popular, and for the sake of simplicity the latter alone will be considered.

A pure mineral oil of medium viscosity, such as Colonial-Beacon Kenmore Quenching Oil, will be found satisfactory. The work should be removed from the furnace and plunged as promptly as possible well beneath the surface of the oil and agitated to prevent the oil that is in contact with the hot steel from burning on and forming an objectionable deposit of carbon. It is well to have a wire mesh basket in the tank to prevent the work from falling to the bottom, into the sediment which may have lodged there.

In large installations it is advisable to have a mechanical means for agitating the oil, to prevent the carbon deposit mentioned above and also to better distribute the heat. Best results will also be obtained if the oil can be maintained at a temperature of from 100 to 150 deg. F., although there is some controversy on this point. In large tanks this can be done electrically.

Since the viscosity of the oil has a direct effect on its quenching speed,

it is well to obtain an oil which is as free as possible from volatile elements. Such elements will be dissipated by the heat and the viscosity of the oil will therefore gradually be increased. The oil should be kept clean and should be changed at frequent intervals to maintain uniform results.

In many cases a certain amount of carbon deposit is inevitable with high speed steel, and where it is necessary that it be removed, the job may be done with a wire brush, a low-pressure sand blast, or by pickling for a short time in one of several different kinds of acid solutions. The latter is preferable if the deposit is particularly tenacious. However, if the work is handled properly, there will be no deposit which cannot very easily be polished off.

Where high speed steel tools must have considerable strength as well as hardness, it is advisable to temper them at once, after removing from the oil, by reheating slowly to a temperature of 1050 deg. F. and allowing them to remain at this point until they are thoroughly heated. Care must be taken at the first quenching, however, that the temperature be brought down to 600 deg. or less, otherwise the tools will not temper properly. In some shops it is common practice to cool the piece until it can be touched with the hand without burning. This secondary hardness is greatest when the steel is drawn near 1100 deg., and the toughness is greatest as the temperature approaches 900 deg. The tools should not be quenched after tempering, but should be allowed to cool in air.

Carbon steels vary greatly in analysis, and are generally hardened at temperatures between 1350 deg. and 1500 deg. F. As their critical temperatures are often confined within a narrow range, it is essential to con-

sistent good work that some type of temperature indicator or control be used. A tool with a thin edge or light section should be quenched at the lower end of its hardening range and tools with heavy sections at the upper end. Some types of tool steels should be left at the critical temperature for a considerable period. Data as to hardening ranges and critical temperatures will readily be furnished by the manufacturers of the steels.

Long, slender tools, such as long taps, are best hardened in a vertical muffle furnace, while thin tools and dies should be rested on a horizontal surface while being heated. When quenched, long tools or those with round sections should be plunged vertically into the oil, and should be moved up and down or rotated on their axes, but they should never be moved sideways.

For quenching carbon steels, a compounded mineral oil such as Colonial-Beacon Quenching Oil C will give good results. Rape oil, whale oil, or tallow are also used, but not as widely, due to several objections. Certain types of tool steels may be hardened satisfactorily in water, but in this case the quenching action is so fast that tools or parts of complicated shapes are very likely to crack due to the great stresses set up. Such pieces should be quenched in oil. Distortion is also greatly lessened by the use of oil as a medium.

Carbon steel tools should practically always be tempered, since their original brittleness makes them unfit to withstand any great strain. Tempering is also necessary to relieve the strains set up by the quench. Gages and milling cutters, if subject to normal loads, should be drawn to light straw color, reamers and taps to dark straw, and screw dies, piercing dies, and punches should be tempered to purple. Tools with very

delicate sections or those which must withstand heavy shocks should be drawn even further. This tempering may be done in a furnace or open flame and the temperature determined by the color, but for more consistent results it should be done in a lead or oil bath equipped with a temperature indicator.

Carburization—It is frequently desirable to manufacture parts which must be hard on the surface, but with soft cores to increase the strength and ability to withstand shock. Such parts can be made from either machine steel or cold drawn steel, or preferably from steel made especially for the purpose. The parts should be packed with ground bone in a steel tube, closed at both ends, and then heated in a furnace for such a period of time as will produce the depth of case required. The tubes need not ordinarily be of any particular thickness, but should have a wall of at least $\frac{1}{8}$ in., so that they will be able to withstand several heats. At a temperature of 1500 deg., the carbon from the bone will penetrate the steel to a depth of approximately $\frac{1}{4}$ in. in three hours. The work is allowed to cool slowly, and then may be hardened and drawn as for water hardening steel. Complicated shapes, however, had best be quenched in oil. The pack or case hardening tubes should be made of heat-resisting steel if they are intended for continuous use. While there are elaborate case hardening furnaces available and several methods of obtaining the same results, the means and method described above are available to every shop and are extremely useful on occasion.

Proper heat treatment in its various forms is a complicated art, the best methods for which can only be determined by experience and study of the particular problem. However,

the average toolroom or shop can obtain excellent and uniform results by following the foregoing outline and by the use of an efficient furnace of a size adapted to its work.

Handbook and Catalog M32 of Carboly Tools

As a definite step to eliminate the confusion that has existed heretofore in regard to the range of tools to which cemented tungsten carbide may be applied, the Carboly Company, Inc., 2485 East Grand Boulevard, Detroit, Michigan, has issued Handbook and Catalog No. M32 of Carboly Tools.

The tools described and illustrated in this book include not only the standard and special tools made by Carboly Company, Inc., but also those of the manufacturers who are licensed to supply their own types of tools equipped with Carboly. In most instances, the manner in which the Carboly is applied is illustrated by drawings.

The book also contains a section devoted to general information regarding the manufacturing processes, properties, grinding and lapping data, instructions as to brazing Carboly blanks to shanks made by the user, drawing and extrusion dies, operation recommendations, and other information that might be of interest to the user or prospective user of tungsten carbide tools.

Mechanical executives who address the Carboly Company as above may receive a copy of the book without charge.

Catalog of Blanchard Automatic Surface Grinders

Blanchard Automatic Surface Grinders No. 16-A and 16-A2, designed for quantity production on the smaller pieces, are fully described and illustrated in Catalog 74, which is now being issued by The Blanchard Machine Co., 60 State Street, Cambridge, Mass.

In addition to the photographs and descriptions of the machines, a number of jobs in process of production are shown, and data is given as to the kind of work, material, amount of stock to be removed, limits, and production. The information is supplemented by cross section drawings. The book should be valuable to the production executive. Copy free upon request.

Manufacturing Dies and Molds by the Hobbing Process

*Dies and plastic mold cavities are readily duplicated
by this process, in which cold steel is made
to flow under extremely heavy pressure*

By L. DOERFLER

President, L. Doerfler Manufacturing Co., Inc.

IN THE making of dies for the molding of plastic materials and for some other processes, such as die-casting or coining, a number of problems are presented that cannot economically be met by the usual machining methods. Relatively simple shapes are easily machined; some that are more complex are handled to advantage with special forms of engraving machines, but there are jobs of a certain type that can best be produced by the use of a hydraulic press, using a tool that is known as a hob. This tool, being a male member, is usually much easier to machine than a cavity of corresponding design. In addition—and this point is highly important—the hob can be used to make a number of duplicate pieces.

A hob can be given practically any form that may be required on a molded piece, but of course cannot be undercut. Letters can be engraved, or surfaces can be knurled, fluted, or ornamented, and the designs will be reproduced exactly when the hob is sunk into a die block or mold. If the mold is to have several cavities, as is usually the case when the molded parts are to be produced in large quantities, the impressions are "hobbed" in a number of die blocks and the latter are afterward assembled in a suitable chase which usually forms one half of the mold.

The operation of hobbing requires, initially, a hob upon which is duplicated, in shape and surface details, the design of the piece that is to be made. This hob is forced, cold, into a cold block of steel, to the necessary depth to obtain the impression desired.

The hob is machined from a high grade of tool steel which usually contains from 0.80 to 0.90 per cent of carbon, and in the making of the hob the usual machining and hand operations are required. In general, the work is similar to that of die-sinking. For instance, the hob must be made with a small amount of draft so that it will clear properly when withdrawn from the die. When the hob has been properly shaped, it is heated and quenched in cold water or chilled brine to make it glass hard, and then is drawn to from 400 to 500 deg. F. to reduce the brittleness. Then it is polished to remove all scale and surface imperfections, as the slightest flaws will be reproduced in the mold cavities that are produced by the hob.

In general, hobs are made as short as is convenient and still facilitate handling, to avoid the possibility of bending. Unless the impression is quite large, the hob generally projects about an inch or a little more from the die block when it has been sunk into it. The upper end of the

shank, of course, is machined square with the axis of the hob, so as to afford a good bearing surface and to avoid any tendency of the hob to cock to one side when it is forced into the die block. Before hardening, the shank is drilled and tapped so that a screw may afterward be inserted to facilitate pulling the hob out of the work. Shanks are usually made of about the same size and section as the impression so that supplementary blocks can be pressed against the die block when and if the metal tends to draw away from the side of the hob.

The success of hobbing naturally depends upon the plasticity of the material which is displaced when the hob is forced into the die block; consequently, the block must be well annealed. The material used is ordinarily a good grade of soft machine steel, containing around 0.08 to 0.10 per cent of carbon. Although hobbing is sometimes done in tool steel, frequent annealing of the latter is required; perhaps one anneal for each $\frac{1}{16}$ in. that the hob is sunk into the metal. This, of course, is because the material is compressed and work-hardened by the very heavy pressures applied to the hob. These ordinarily vary from 50 to 200 tons per square inch, depending upon the character of work being done.

Metal which is displaced by the hob must flow, and this naturally results in distortion of the metal of the die block. If the block is not confined, it will bulge at the side and the impression will be slightly larger than the hob, but this is close enough to it to answer the requirements of some classes of work. For accurate work, where the impression must match the hob exactly, it is common practice to confine the die block in a heavy chase composed of a hardened steel bushing with heavy walls pressed into a larger and heavier ring of pack-hardened machine steel. In this case the die

block is cut from cylindrical bar stock, turned to a diameter such that it will be a press fit in the hole of the hardened bushing.

In general, the die block is two to three times the diameter of the cavity to be sunk into it, and ordinarily is machined flat on its bottom face, but sometimes the bottom is cupped out to permit the metal to flow downward.



Watson-Stillman press employed for hobbing. A hob is shown sunk into the block contained in the heavy chase and resting against a hardened block. The next operation is to remove the hardened block and press the hobbled block out of the chase while the latter is resting on the parallel blocks.

The top face may be flat or slightly conical, or it may be partly machined to form an initial cavity. This depends, in part, upon the shape of piece to be formed, the depth of cavity to be produced, and the way in which it is desired to make the metal flow. Simple symmetrical forms and shallow impressions require less skill than unsymmetrical or complex forms involving deep recesses. In the latter case much depends upon the experi-

ence and judgment of the mechanic.

Various types of hydraulic presses are employed, depending upon the size and character of work undertaken. In the L. Doerfler Manufacturing Company's shop, which specializes on work of this nature, a 500-ton Watson-Stillman press is used to good advantage. Other shops use the Burroughs type of machine with cast frame. It is necessary, of course, to have a pump capable of developing the high line of pressure necessary to produce the very heavy total pressure required for hobbing, and it is also helpful to have a pump that is capable also of delivering large quantities of oil or water at lower pressures so that the rams can be made to move rapidly to and away from the work. In any case, gradual application of the pressure during the hobbing operation is desirable in order that the metal may have time to flow. In some cases, and especially if the impression is not very deep, it can be made in a single push, but for accurate work in which the die block is confined in a chase it is customary to do the work in separate pushes of $\frac{1}{4}$ to $\frac{3}{8}$ in. at a time with annealing between.

In most cases it is not necessary to locate the hob exactly in the center of the die block. Location by eye is sufficiently accurate, as the block is always machined outside after the impression is completed, and then the location of the impression in reference to various surfaces is readily adjusted. When the die block is ready for the impression, it is first forced into the chase in the hobbing press, the chase resting upon a hardened steel block of about the same diameter. The hob, with its upper end resting against another hardened block of steel in contact with the upper platen of the press, is then brought into contact with the die block.

With everything ready for the operation to begin, the control valve is

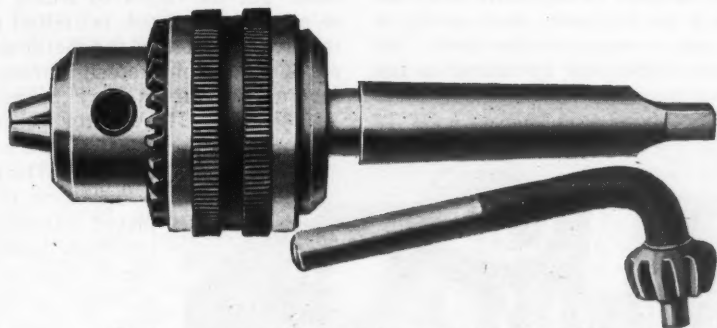
opened to the high pressure line and the operator watches the pressure gage. The pressure increases for a time as the hob is forced into the block, and then becomes almost constant as the hob sinks lower into the piece. When a certain depth is reached, however, the pressure increases rapidly, indicating that the hob is "home," or that further annealing is required before the operation can be continued.

In case the metal has drawn away from the hob, a split ring or suitably shaped blocks are placed around it and are then forced downward, compressing the metal and forcing it against the hob. The flow of metal naturally distorts the top surface of the block, but enough leeway is left so that in final machining this and other surfaces will "clean up" properly and give a surface that will mate properly with other portions of the completed die or mold. Actual hobbing may take one to two minutes or less, but supplementary operations require considerable time.

After hobbing, the chase, with the die block in it and the hob still in the block, is turned over and rested on a pair of parallel blocks while the die block is pressed out. To facilitate removal of the hob from the die block, the latter is rested on a block of steel and is struck several blows with a hammer around the cylindrical surface. It is then clamped in a vise, and a screw passing through a steel bar is threaded into the hob shank. The bar rests against two blocks seated against the die block, and when a nut is turned down against the bar the hob is pulled out.

If the cavity is of the required depth, the die block is complete, so far as the cavity is concerned, and is ready to have the outside surfaces trued up. If the hob must be sunk deeper, the block is annealed before the operation is continued. Ordinarily

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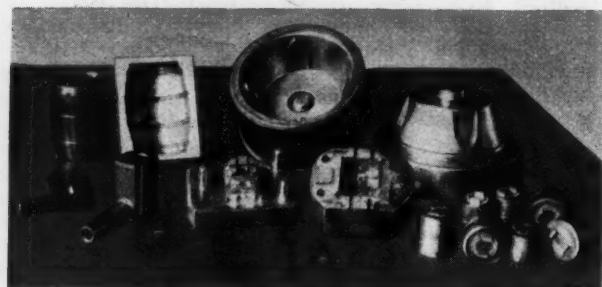
J. R. Almond Mfg. Co.,
Ashburnham, Mass.

ily, cavities show a surface finish equal to that of the hob and require no further finishing except for polishing after pack-hardening; but if more than one push has been made in hobbing the cavity, a little hand scraping and extra polishing may be required.

When a mold having more than one cavity is to be made, each cavity is sunk into a separate die block and then all blocks are machined to the same outside dimensions, usually with

mate exactly with the force it is to form. Sometimes such a cavity can be machined into the block, but in other cases it must be hobbled, which, of course, involves first making a hob of the required shape. This is sunk into a well-annealed block of tool steel, but the depth to which it can be sunk in each push is limited by the relative hardness of the metal as compared to machine steel, consequently several annealings may be required

even for forming a relatively shallow cavity. When such a die-block is completed, hardened and polished, however, it can be used to make a large number of forces. These forces are made by pressing machine steel blocks into the cavity in precisely the same way that cavities are formed by forcing a hardened hob into soft steel blocks.



Group of small molds made by hobbing. In the center is a sample mold, both halves of which have been hobbled, but the male half has been slotted after hobbing. The large mold in the background is formed with the hob shown to the right of it. Small "forces" at the right with male projections are formed with the female hob at the left. Pipe bowls and barrel at left are phenolic parts formed in hobbled molds, one of which is shown.

square or oblong section, and are assembled into one frame or chase. It then remains to make the other half of the mold. The other half may be merely a flat plate, it may have hobbled cavities sunk into it, or it may be fitted with mating male members or "forces" as they are termed, which project into the cavities previously formed in the other half of the mold. If cavities are required in the upper half, they are hobbled in the same manner as those in the lower half. Forces are sometimes machined, sometimes are hobbled and sometimes require a combination of the two processes.

To hob a force, it is first necessary to make a glass-hard die block from tool steel, having a cavity such as to

The accompanying illustration shows several examples of hobs and hobbled parts. An examination will show that it would be difficult—if not impossible—to make some of the pieces by any other method than hobbing. Examples of forces made by hobbing are also shown, as are also some phenolic molded articles made in hobbled molds, and one sample mold and force for making an electrical part having a thin wall with webbed spacers or supporting members. The latter is an example of work in which a combination of machine work and hobbing are required. The force has some projections which are relatively long and slender and which could not be hobbled without the probable breakage of the hob. Con-

sequently, the irregular contour of the force is hobbled and the narrow slots are afterward machined.

In making the molds for forming the smoker's pipes shown in the illustration, both halves of the mold are hobbled. The lower half has a cavity which forms the neck (to which the stem is afterward threaded) and about three quarters of the bowl portion. The remaining portion of the bowl is formed by a cavity in the upper half of the completed mold. To make the neck recess in the lower half of the mold by hobbing alone would be difficult, and would probably result in breaking the hob, especially as the portion forming the neck is offset from the center of the hob. Before hobbing starts, therefore, the die block is drilled and machined to form a tapered hole approximating the neck below the bowl recess. When hobbing is done, the projecting portion of the

hob enters the hole previously machined and pilots the hob as the latter forms the bowl and the fillet which joins it to the neck.

After hobbing is finished on die blocks for the pipe mold, the lower block is machined to receive a fixed pin to form the hole through the neck and a removable pin or plug which forms the cavity within the bowl. The ornamental panels on two sides of the square-sectioned pipe bowl shown are readily formed in the hobbled impression, but the other two faces have to remain plain, as any recessing would not permit the hob nor the molded piece to clear when withdrawn.

As will be seen from the illustration, hobs of large diameter are sometimes sunk into the die block to a depth of two to three inches, but in general the depth of cavity formed does not exceed and usually is much less than the diameter of the hob.

Recommended Grinding Practice for Carbide Tools

1. Always grind toward (never off) the cutting edge; feed the grinding wheel only when rotation of the wheel and movement of the table (in surface grinding) are toward the cutting edge.
2. Grind either all wet or all dry. Intermittent cooling causes strains and cracks.
3. Use lighter wheel feeds and softer wheels when grinding the harder grades of carbides.
4. Use soft, open-structured wheels for broad contact and relatively harder, closer-structured wheels for narrow contact.
5. Appoint and train one man or a special crew to grind all the tungsten

and tantalum carbide tools in your plant.

6. Never quench a tool tip in water to cool it after grinding. If air cooling is not fast enough, hold the steel shank in water, but not the tip.

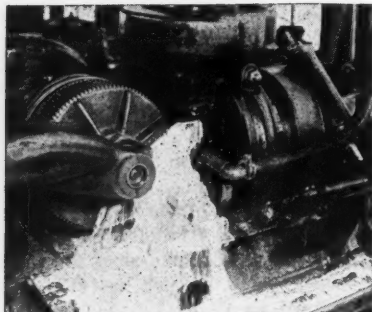
7. Keep front clearance angle beneath the cutting edge as small as possible, consistent with requirements of the job.

8. The grinding machine should be in first class condition and must be at least as vibrationless and accurate as the machine in which the tool is to be used.

9. Regrind or lap as soon as there is any sign of wear. Worn tools fail due to excess pressure and friction. Do not try to set up "endurance records" with the tools. A chipped tool may require an excessive amount of grinding to bring it back to a useful condition.

(From "Grits and Grinds").

ACCURACY with LONG RUNS



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OPERATION: HOBGING "EXCELSIOR" FLY-WHEEL STARTER GEARS.
MACHINE: LEES-BRADNER HOBGING MACHINE.
MATERIAL: 50-60 CARBON STEEL.
GEAR: 8-10 PITCH .225 IN. DEEP.
CUTTER SPEED: 108 R.P.M.
FEED: .000 IN. PER REVOLUTION OF WORK.
LUBRICANT: 1 PART SUNOCO TO 10 PARTS WATER.



Courtesy of
The
Springfield
Manufacturing
Company,
Springfield,
Ohio

OPERATION: CHAMFERRING CUT TEETH OF "EXCELSIOR" FLY-WHEEL GEAR.
MACHINE: GOULD & EBERHARDT HOBGING MACHINE.
TOOLS: HIGH SPEED STEEL FORMED CUTTERS.
STOCK: 50-60 CARBON STEEL FORGING.
SPEED: 152 TEETH PER MINUTE.
LUBRICANT: 1 PART SUNOCO TO 15 PARTS WATER.

The development of machine tools which will stand up under heavy cuts at high speeds has stimulated the small tool manufacturers to produce tools with which these speeds and cuts can be taken. The efficiency of both machines and tools is lessened through excessive tool regrinds. Dull tools and frequent "set ups" produce work lacking in accuracy and finish.

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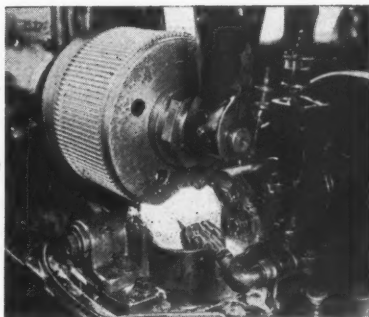
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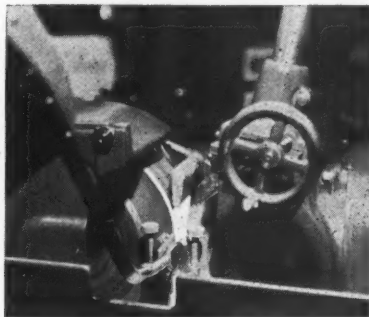
mont, Bridgeport, Buffalo, Chicago, Cincinnati, Cleveland, Columbus, Jacksonville, Miami, Montreal, Newark, New York, Philadelphia, Pittsburgh, Tampa, Toledo, Toronto, Trenton, Tulsa, Wilmington, Youngstown.

Courtesy of
The
Springfield
Manufacturing
Company,
Springfield,
Ohio



OPERATION: HOBGING "EXCELSIOR" FLY-WHEEL STARTER GEARS.
MACHINE: BROWN & SHARPE NO. 34 HOBGING MACHINE.
MATERIAL: 50-60 CARBON STEEL.
GEAR: 8-10 PITCH 225 IN. DEEP.
CUTTER SPEED: 120 F.P.M.
FEED: .090 IN. PER REVOLUTION OF WORK.
LUBRICANT: 1 PART SUNOCO TO 10 PARTS WATER.

Courtesy of
Cincinnati
Grinders, Inc.,
Cincinnati,
Ohio



PART NAME: PISTON PIN.
MACHINE: CINCINNATI CENTERLESS GRINDER.
MATERIAL: HARDENED STEEL.
LIMITS:
ROUND WITHIN00005 IN.
STRAIGHT00005 IN.
SIZE0001 IN.
STOCK REMOVED: .001 IN.
PRODUCTION RATE: 28 PER MINUTE.
LUBRICANT: 1 PART SUNOCO TO 40 PARTS WATER.

The Use of Leather Belting in the Transmission of Power, III

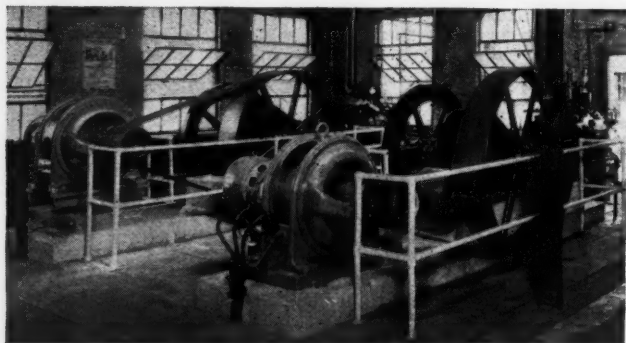
The Third and Last Article, in Which the Authors Discuss Short Center Driving With Flat Belts, Pivoted Motor Drives, and Belts for High-Torque Motors.

By PHILIP C. BROWN, GEORGE B. HAVEN, AND GEORGE W. SWETT*

IN the two preceding articles of this series, the authors have attempted to show the desirable features of motorized group drive. The present dis-

of drive with which a binder pulley is used is of older origin and in many cases has been so badly engineered that the belt has given trouble and,

of course, has carried all the blame. Consequently most belting manufacturers have looked with disfavor upon this type of drive. In any case, the drive places many hardships upon the belt. The worst features of the binder type can, however, be minimized by proper engineering.



Westinghouse synchronous motors driving 110 h.p. air compressors. The compressor in the foreground is equipped with an idler drive, but the idler is unbalanced and the tension, therefore, is increased instead of decreased. The drive on the compressor next to the window is a Rockwood drive with automatic tension control.

cussion covers particular individual applications in a group-driven shop, where the drive is in each case confined to the driving of one machine. The drives under discussion are usually referred to as "short center drives." These drives are of two types.

Swinging Binder Drives—The type

Short Center

Drives—The best belting practice has

always called for

the use of the "long center drive," in which the driving pulley is relatively far from the machine to be driven, and a correspondingly long belt is required. Such a drive has one great advantage: the weight of the belt in the slack side prevents the tension in that side from becoming too small when the load is applied. This results

* George B. Haven is Professor of Advanced Machine Design and George W. Swett is Professor of Machine Design, both of Massachusetts Institute of Technology. Philip C. Brown is President of I. B. Williams & Sons, and Chairman of the Engineering Committee of the American Leather Belting Association.

in a considerable increase in the power that can be transmitted without undue slip. When the slack side is above, there is the further advantage of a somewhat larger arc of contact.

At present, however, there is a decided trend toward the "short center drive." This is due in part to economy of floor space, together with the increasing use of the electric motor as a prime mover, and in part to the tendency of machine designers to incorporate the motor as an integral part of the machine to be driven. This drive has advantages, although it often involves unnecessarily high initial and operating costs.

Use of Gravity Idlers—The high speed at which induction motors run generally makes necessary a considerable speed reduction, which is often secured by using a large pulley on the driven shaft and a relatively small one on the motor. The combination of high pulley ratio and short center distance gives an arc of contact often much less than 180 degrees. This circumstance, together with the low tension on the slack side of the belt due to lack of sufficient belt weight, renders this drive both inefficient and unreliable unless excessive belt tension is applied and carefully maintained.

These disadvantages of the short center drive may be largely avoided by the use of a "gravity idler," or loose pulley mounted on a pivoted arm and held against the slack side of the belt by a weight. The belt is usually installed rather slack, and the idler placed near the smaller pulley, in order to wrap the belt around the latter as far as practicable. It should not be placed too near, however, for reasons given later. The idler pulley

should be uncrowned. It should be mounted in ball bearings, and provided with suitable adjustments for accurate lining up. The swinging arm should be equipped with such weights or counterpoises as may be

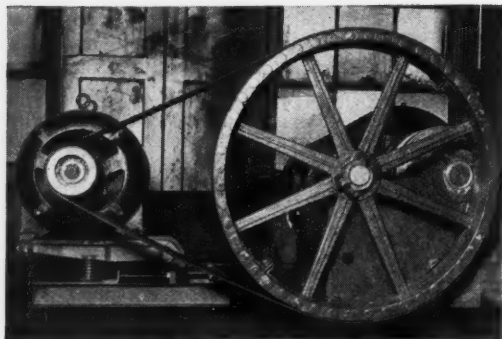


Rockwood drive as applied to a lineshaft. As the tendency toward increased lineshaft speeds increases, the size of the driven pulley will be reduced. Note the very short center distance—just enough to allow for clearance of the two pulleys.

needed to secure the proper pressure against the belt. Gravity idlers may be designed to work equally well for drives which are horizontal, or at any slope.

To sum up: the chief advantages of a gravity idler are that it adjusts itself to the length of the belt and to its varying tension, taking up slack and maintaining a suitable tension in the slack side of the belt, thus postponing the time when the belt must be shortened, and increasing the arc of contact on the pulleys. Over against these benefits there are some disadvantages.

There is a slight loss of power in the idler bearings, although with ball bearings this will be small. The belt suffers a reverse bend around the



The Rockwood drive base lifts the motor off the floor from 5 in. to 10 in. and keeps it away from floor dirt and grit. The importance of perfect control of belt tension is apparent when it is considered that on an air compressor such as this one, the annual power bill equals the first cost of the compressor.



idler, so that the fibers on the "pulley side" of the belt are stretched, as well as those on the outside. This tends to shorten the life of the belt, especially when too small an idler is used. Good practice demands an idler as large as the small pulley in the drive, but for economic reasons this demand is not always met.

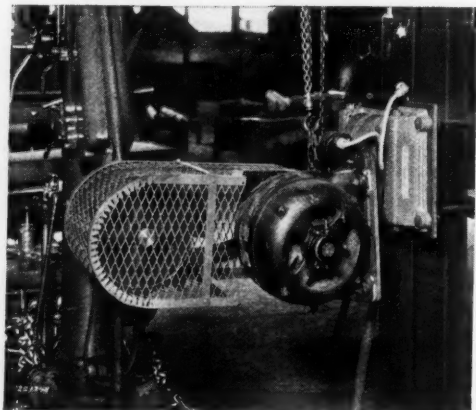
The portion of belt between the crowned motor pulley and the flat-faced idler is always subjected to a "crinkling" strain, frequently resulting in breakage near the center line. This is especially likely to occur when the crowning is excessive, and when there is too short a length of free belt between the idler and motor pulleys. It is a good rule that the distance between these pulleys shall not be less than the width of the belt. Any crown on the idler would, of course, make matters worse.

This center break is particularly troublesome in wide belts with the backbone in the center of each ply. The backbone section is composed of the

shortest and most compact fibers with the least stretch availability; consequently breaks across the backbone

are very common on ill-designed drives. In this connection, it seems advisable to specify again some of the points which the best engineering knowledge in the trade consider necessary to the proper designing of these idler units:

1. Idler pulleys must be flat faced and have such bearings as to keep them in perfect alignment; anti-friction and self-oiling bearings preferred.
2. All other pulleys on such a drive must have a minimum crown. The increased diameter of the pulley at the crown over the diameter at the edge should not be over one-eighth inch per foot of pulley width, preferably less.



Standard Rockwood short center drive applied to a 5 h.p. 1200 r.p.m. motor driving a drill press. Pulley diameters, 3 in. and 12 in. Center distance, 19 in. Note the method of clamping the drive base to the steel pillar in a vertical position.

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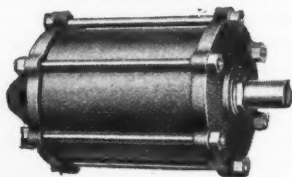
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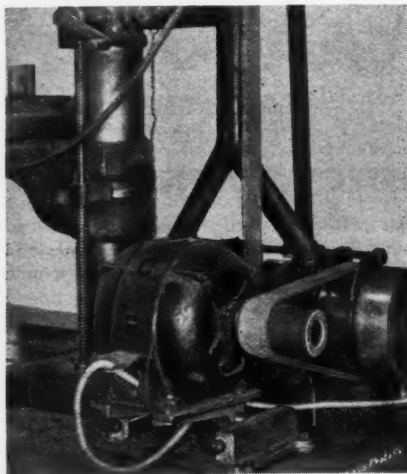


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3. The diameter of the idler pulley must be at least as great as that of the motor pulley or other small pulley in the installation.
4. All pulleys in the installation must be in careful alignment.
5. Motor pulleys of diameter smaller than standard shall not be used.
6. The idler pulley shall be so located that the length of belt from the



Rockwood short center drive applied to a drill press, using a floor mounting that permits the shifting of belts. The center distance is 18 inches.

point where it leaves the motor pulley to the point where it passes onto the idler pulley shall never be less, but preferably more, than the width of the belt.

7. In installations of pulsating load, or where sudden overloads may be met momentarily, the idler pulley should be controlled with some device to prevent jumping. Such a device is similar to a shock absorber, and may be accomplished by the use of some sort of dash-pot arrangement.

Pivoted Motor Drives—A more recent development in short center driv-

ing is what is known as the pivoted motor drive. The drive has proved so satisfactory from the belt makers' point of view that the trade in general is fostering this type of installation. Very careful engineering tests run at the University of Cornell showed that the drive possessed extraordinary efficiency and large overload capacity, with reasonable loading and flexing of the belt. For short center driving, this type of installation should receive the most careful consideration.

Weight of Motor Used to Tighten Belt—In one of the most recent developments for short center driving, the motor is swung from a pivot, and a component of its weight is employed to produce tension in the belt. The usual motor base is replaced by a pair of arms, having lugs at one end through which a heavy horizontal pivot rod is passed. The motor hangs upon this pivot and is drawn to one side just far enough to secure the proper belt tension. The ends of the pivot rod are provided with adjustments for lining up the pulley and securing the desired initial tension.

This drive has all the advantages of the gravity idler drive, except increased arc of contact, without its disadvantages. It has already proven its practicability, even under severe conditions. This type of drive avoids reverse bending of the belt, the tension being automatically maintained. The slack caused by centrifugal force

The operating tension may be considered as a force taken from the slack side and added to the operating side. As the lever arm of the forces on the slack side (tight side nearest motor pivot) is greater than the lever arm of the forces in the tight side, such a shift of forces automatically reduces the moment of forces, counterbalancing the weight of the motor. This makes the motor moment just that much more effective.

and operating tensions is taken up as it develops.

If this drive is engineered to the best advantage, the operating tension will increase the effectiveness of the motor weight (see foot note); that is, the greater the load the more tension is given the belt to develop its work. This is particularly helpful in starting and on peak loads. A final advantage of this type of drive is that the tensions just discussed are released when the motor is idle. As the motor stops and the stretch, due to centrifugal forces and operating tensions, is released, the motor rises and the belt shortens. This gives the belt periods of rest and relaxation which generally prolong its life.

This article, from its title, presumed to discuss only short center drives. There is, however, another motor application of special nature that we desire to bring to the attention of machine shop engineers. In the last few years, most motor manufacturers have offered for sale what is known as a high torque or "line-start" motor. Due to its great overload capacity, which often is 200 per cent for short periods, the belt has sometimes given trouble. This is due to a lack of foresight in not providing a pulley of sufficient size to carry a larger capacity belt.

Line-start motors are designed to start at the full current without the use of compensators or other apparatus. They come to speed very promptly and save much valuable time in accelerating production. Naturally they have a very high starting torque, since the current goes at once and at full amperage to the rotor. Such motors have come to be very widely used, and range in size from 5 h.p. to 30 h.p.

However, it is a mistake to equip a line-start motor, adapted to a starting torque of from 200 to 300 per cent

of normal, with an ordinary belt. The motor itself has to be especially designed for this operation and the belt that is used with it should be adapted for extra severe usage. Belts selected for use with such motors should be from 25 to 50 per cent wider than those ordinarily provided. This practice will maintain a reasonable factor of safety in the belt and enable the user to obtain the full advantage of the line-start feature of the motor.

The points enumerated above are high spots only in the proper application and use of leather belting. Careful attention to this phase of machine operation will pay good dividends.

"Master" Data Book On Geared Head Motors

Data Book Section 210, presenting 20 pages of descriptive matter and illustrations showing the Master Geared Head Motor in service, has been issued by The Master Electric Company, 104 Davis Avenue, Dayton, Ohio. Cut-away views show the application of the motor to parallel shaft and right angle drives, as applied to machine tools, vacuum pumps, slow-speed pumps, winches, air compressors, slow-speed fans, slow-speed mixers, conveyors, polishing machines, and other mechanical units. Examples are given of the flexibility of design, and engineering data is provided with which the engineer may be guided in the selection of a motor for his particular application. General information as to lubrication, installation, and operating temperatures is included. A copy of the section may be had by addressing this firm as above.

"Industrial News"

The Square D Company, Industrial Controller Division, Milwaukee, Wis., has published a four-page newspaper called "Industrial News." The sheet is standard newspaper size, and the "news" consists largely of stories of the application of industrial controllers to all sorts of mechanical apparatus, the information being gathered from all over the world. Plant engineers and others interested in electrical control apparatus can secure copies by sending their request to this firm at the above address.

Westinghouse Studies Corrosion of Welds

THE effect of corrosion is becoming so important in welded boilers, pipes, containers for oil and chemicals that the Westinghouse Research Laboratories are studying it with special apparatus. In welded structures of rustless steel, alloys, or monel metal this problem is vital. The results of these studies may tell engineers how to fabricate structures so that all parts will be uniformly resistant to rust.

In a weld of low-carbon steel, corrosion may be expected to start in the zone where weld metal meets parent metal. At this point, according to the electrolytic theory of corrosion, a potential difference may exist which is responsible for an accelerated attack. Oxides and other heterogeneous particles, if present in the weld, tend to hasten corrosion by the formation of electrolytic cells. The soil corrosion of pipe line is an example. A more homogeneous weld should be expected with coated welding wire than with bare electrodes, since the coating will resist

the intrusion of foreign elements.

To corroborate many facts already known on this subject and to uncover others, a special corrosion device has been built which greatly hastens the

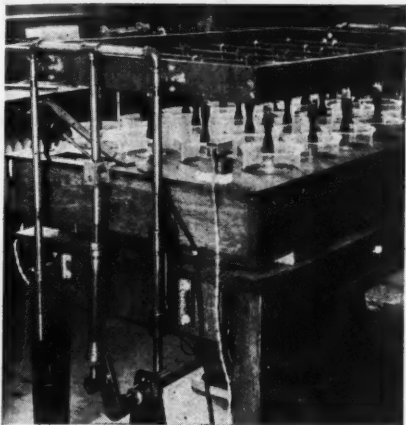
ordinarily slow process of rust. In it the test specimens are subjected to intermittent immersions in a corroding liquid. The apparatus suddenly immerses the samples, leaves them at rest for a definite period, and then removes and exposes them to air for a definite period. They are moving only when being lowered or raised — a time which is a very small fraction of the cycle.

Samples are suspended from a

rack by glass hooks, horse hair, or silk and a motor-driven crank shaft raises and lowers the rack. The driving motor is controlled by a timing device composed of a synchronous motor operating a contact, which causes the motor to periodically turn the crank shaft a half revolution. The timing can be set for any cycle of test operation. To obtain reproducible re-



Specimens in Suspension



Corrosion Testing Machine

sults, the corrosive liquids are kept at a constant temperature, by circulating water of a constant temperature along the outside of the vessels containing the corrosive liquids.

Danly Adds Cutting and Welding Department

To facilitate the handling of special die-sets, die shoes, bolster plates, strip-plates, and similar die parts, Danly Machine Specialties, Inc., 2122 South Fifty-second Avenue, Chicago, Ill., has augmented its plant by the addition of a complete torch-cutting and welding department. Equipment in this department includes the newest and latest devices for cut-

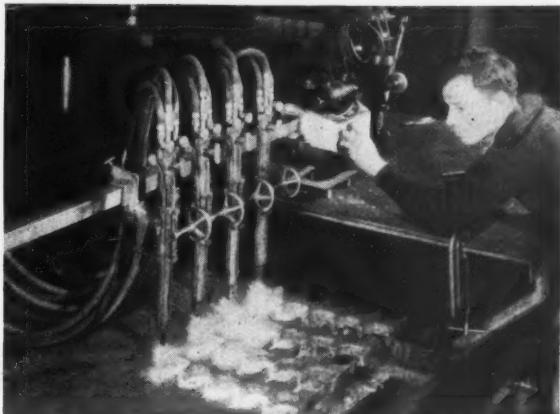
ting and welding on a production basis, including multiple torch cutting equipment such as that shown in the illustration. The machine shown makes it possible, by the use of a pre-formed templet, to duplicate a given shape or form and produce four identical, duplicate pieces at a time, with speed and precision.

The department is also equipped to cut and fabricate steel plate shapes and various welded steel plate units which are difficult to obtain from local supply houses. In addition, a complete stock of steel plate will be maintained at all times in standard sizes, to assure prompt delivery of special orders.

A special bulletin covering this service can be obtained by writing the Danly Machine Specialties, Inc.

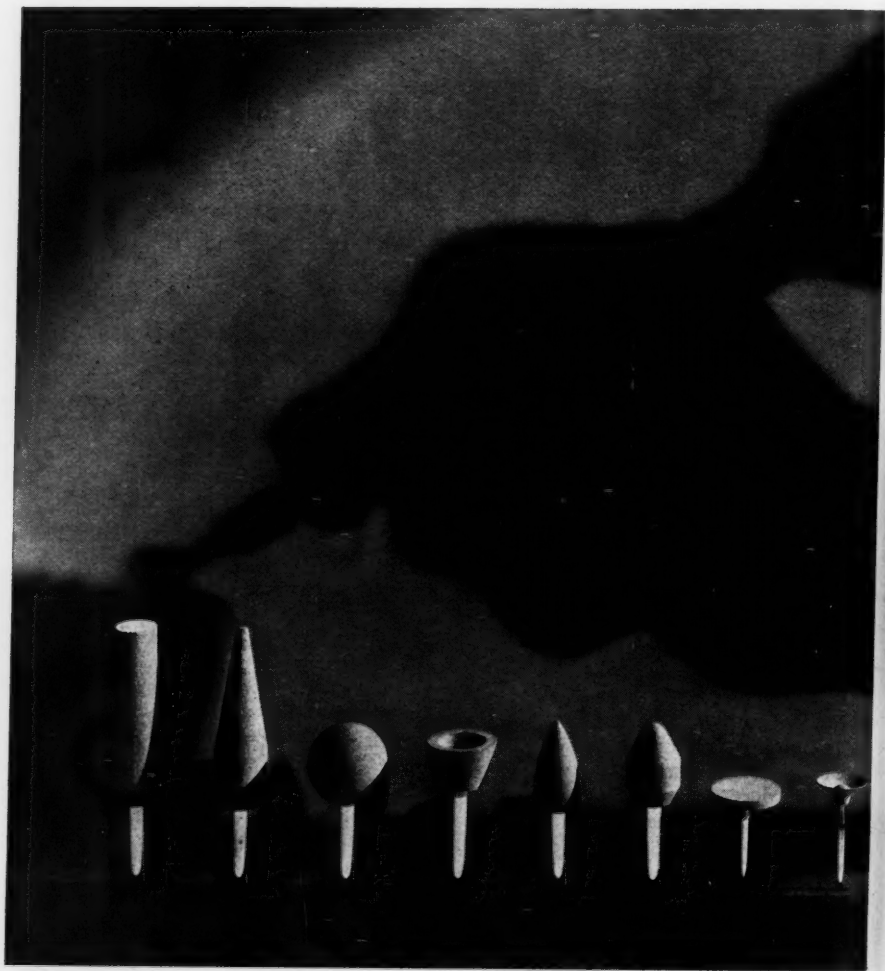
Landis Threading Machine and Tool Catalogs

The Landis Machine Co., Waynesboro, Penna., has issued two new catalogs covering Landis pipe threading machinery and Landis bolt threading machinery, as well as a number of individual bulletins covering Landis thread-cutting die heads and taps. Copies are available to mechanical executives. Inquirers should state the particular size and type of machine or die head concerning which information is desired.



Multiple Torch Cutting Machine in operation at Danly plant.

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POINTS AND WHEELS

Available in a wide range of shapes and sizes



THEY are made of 38 Alundum abrasive with its well-known features for grinding die and tool steels. A special spindle design and a special cement assure a securely anchored mount. With ordinary care Norton points and wheels can be used down to a very small stub—an economy feature that is very important.

Norton Mounted Wheels and Points are available for all of the popular makes of grinders—both internal and the air, electric and flexible shaft types of portable—in all of the popular sizes and shapes, grains and grades.

For grinding cast iron, brass, copper and similar materials there are wheels and points of Crystolon abrasive.

NORTON COMPANY
WORCESTER, MASS.



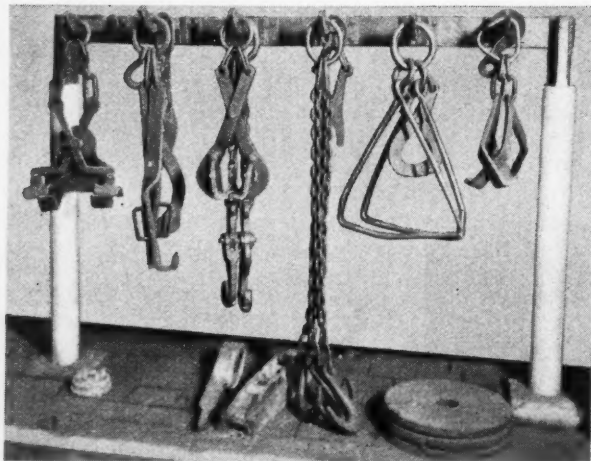
IDEAS FROM READERS

This department is a clearing house for ideas . . . If there is a "kink" or short cut in use in your shop, send in a description of it . . . We will pay \$5 for each one published.

A Better Rack for Crane Hooks and Chains

By J. H. HAHN

HERE is a photograph of a rack for crane hooks and chains that looks just like all the rest of the racks that have been made for this same



The crane operator can pick chains or clamps off this rack without the aid of a helper.

purpose, but isn't. This rack has one feature that is missing on the others. If the chains and hooks are hung on this rack, the crane operator—if he is at all skillful—can pick a chain or a set of hooks off the rack without the aid of a helper.

The horizontal section of the rack is a heavy iron bar, riveted at each

end to a section of steel rail that stands upright in a length of pipe. The pipe is screwed into a flange that is anchored in a concrete base.

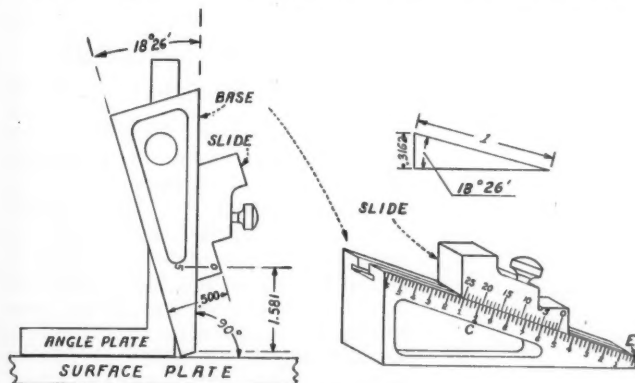
To either side of the horizontal bar are bolted angles, made from $\frac{3}{4}$ -in. plate, in pairs so as to form hinges for the arms upon which the chains and clamps are to be hung. The arm is designed so that, when hinged between a pair of angles, it can be raised vertically but is prevented from dropping below the horizontal. Each arm is pinned between its pair of angles by a single bolt, which serves as a hinge-pin.

When the crane operator needs a pair of clamps or a set of chains, he drops his crane hook until he can slip it into the ring by which the clamps or chains are lifted, and proceeds to lift them. As the chains move upward, the arm rises so that the chains can clear, and then drops back into place again. And it is just as easy for him to replace the chains on the rack. The rack aids in keeping the chains and hooks off the floor, which is the first requirement of an orderly shop.

A Graduated Shaper or Planer Gage

By CHARLES KUGLER

THE drawing shows the design of a graduated gage that is very useful in setting up work on the shaper or planer. The gage consists



A Graduated Shaper or Planer Gage

of a base, slide, and screw with a knurled head on one end and a square nut on the other. The interior of the base is machined out from the bottom and a slot is cut in which the screw can slide. A flat groove on the under side of the slot, wide enough for the nut, will prevent the nut from turning and thus make it possible to clamp or unclamp the slide by simply turning the screw.

The graduations can easily be inscribed on the surfaces of the base and slide if these surfaces have first been tinned by dipping into a bath of molten solder. The lines and figures will be more permanent, however, if stamped into the steel, but it is more difficult to stamp them accurately.

To lay out the graduations, the base is clamped vertically to the side of an angle plate as shown in the illustration. The slide is then adjusted for height so that the dimension through

the step on the slide, together with the base, will be 0.500 in. A horizontal line is then inscribed across the faces of both the base and the slide, to be stamped later with 0 on the slide and 5 on the base.

The angle of the top or sliding surface of the base with the bottom can be made to suit the designer's ideas.

The angle shown in the drawing, however, is 18 deg. 26 min., and if this angle is used, the horizontal line referred to should be 1.581 in. from the lower corner of the upper surface of the base, as shown. Using this angle, one inch of movement of the slide corresponds to a vertical movement of

0.3162 in. when the gage is resting on the bottom of the base. Thus in inscribing the graduations, the dimension between each of the forty lines from C to E will be equal to $3.162 \div 40$, which is 0.07905 in. By using a height gage, the lines can be laid off and inscribed accurately.

The slide has 25 graduations covering the same dimension that is covered by 24 graduations on the base; thus $24 \times 0.07905 \div 25 = 0.07588$ in., which is the dimension between the graduations on the slide.

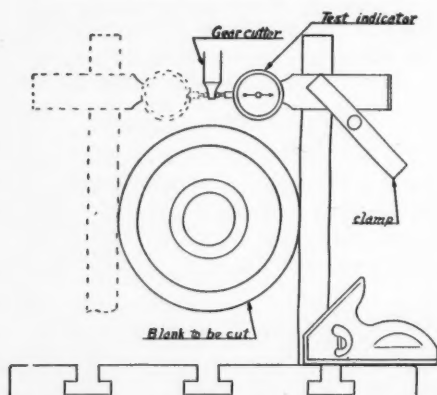
Setting a Gear Cutter Central

By P. L. BUDWITZ

IT is a common incident in the machine shop to see a mechanic setting a gear cutter in a milling machine with the eye. To cut an accurate gear on a miller, it is important that the cutter be set exactly central in rela-

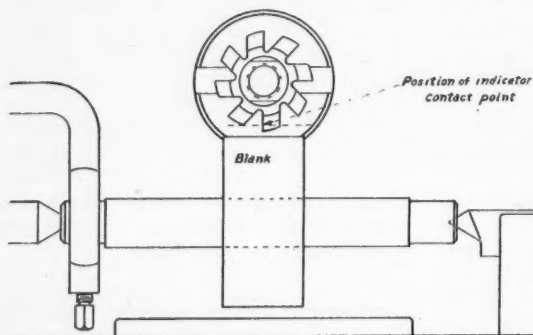
tion to the gear-blank. This point is particularly essential when using a "single purpose" cutter, in order to obtain the fullest benefit of the cutter.

The method of setting a cutter cen-



Drawing illustrating use of indicator in setting gear cutter.

tral as described here is one that I have used successfully. A test indicator is clamped to the blade of a square, and after setting the cutter as nearly central as is possible with



Drawing showing position of cutter for indicating.

the eye, the blade of the square is brought into contact with the blank to be cut as indicated in the illustration. The indicator reading is taken

and then the square is placed in the same position on the opposite side of the blank, as indicated by the dotted line. If the indicator shows a variation, the difference may readily be compensated for by moving the table over. It is important that the cutter be mounted true on the milling arbor before making the test.

Using Paint to Identify Die-Sets

By JOHN MCCULLOCH

THE use of paint on steel or iron to identify the material has been common practice for generations. Paint is easily applied, and usually remains in evidence until the material is used. This idea is now being put to use by a number of large companies in the marking of die sets where a variety of models of similar parts are made. For example, where a manufacturer has two models in production at the same time, it simplifies matters a great deal if the die sets are marked with different colored paints so that the tools for parts of one model can easily be distinguished from similar tools for the other model. It also makes it a simple matter for the foreman or superintendent, when going through the press room, to tell immediately which model each press is working on.

This practice lessens the possibility of the wrong die being selected and the part for one model being made when it is intended to make the same part

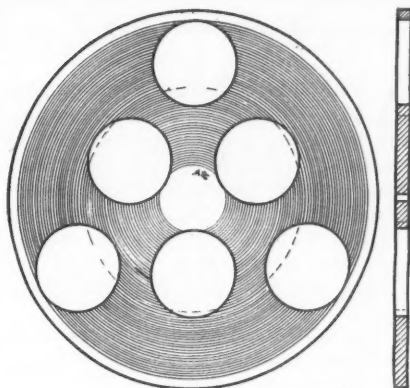
for the other model. It also helps out the toolroom and serves as a double check against the methods in use for marking the dies. Both punch and

holder should be marked, and the paint should be put onto the side of the tool facing the operator when the die is mounted on the press. There is usually ample surface for the paint, without interfering in any way with the working surfaces.

A Centering Disc

By C. T. SCHAEFFER

LARGE shafting and billets handled in the job shop usually require rough centering for turning. A handy disc for such cases can be arranged as shown, locating holes on two different circles and then cutting light grooves to represent increments in diameter of one-eighth inch as shown by the light circles. A small hole for the punch to enter is drilled at the center. In use, the centering disc is placed over the work and lined up



A Handy Centering Disc

with the circle representing its diameter, sighting through the holes which will then be indicated as shown by the dotted lines. The disc can be made any size and thickness, depending upon the range of work upon which it will be used.

THE Stark "ELECTROBLAST" High Speed Muffle Furnace

WHY start your large furnace for single or small lots of high speed or carbon steel tools? This efficient unit will reach high speed heat in 20 minutes at an operating cost of 7 cents per hour.

No scaling or decarburization! No separate blower or piping! Burner may be used separately as a powerful bench torch. Muffle size $6\frac{1}{2} \times 3\frac{1}{8} \times 2\frac{1}{8}$ inches. Price \$70 as shown. It will quickly save its cost.



Stark Tool Company, Waltham, Mass.

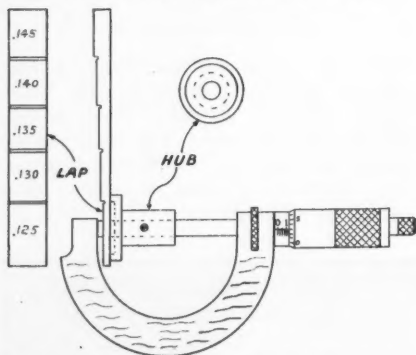
Established 1862 Originators of the American Bench Lathe

Micrometer Lap

By F. J. WILHELM

A VERY satisfactory job of lapping the end of a micrometer spindle can be obtained by the use of the lap shown in the drawing. The outfit consists of two pieces—the lap proper, and the hub. The hub helps to keep the lap at right angles to the spindle and thus insures that the end of the spindle will seat perfectly against the anvil.

The lap can be made of either hardened or soft steel. It is made with five



Equipment for lapping end of micrometer spindle.

working surfaces, or steps, varying by 0.005 in. so that when the entire range of five surfaces has been used in lapping a spindle, the spindle has been revolved one complete revolution. This method insures a uniform surface on the end of the spindle. The hub is of steel, bored and lapped to a push fit on the spindle, and with a hole for a setscrew by which it can be locked in position. The face of the hub is lapped to a smooth seat and square with the bore, and is recessed to allow plenty of room for the lapping compound.

To operate, the hub is slipped over the spindle, then the lap is placed in position and the anvil is screwed light-

ly against it. The hub is also moved into contact with the surface of the lap and is anchored in position. The lap can then be released and a small amount of flour emery and oil rubbed over the end of the spindle or on the surface of the lap. The spindle is screwed up against the lap again and the lap is then moved by hand over the surface of the spindle with a rotary movement. The lap can be reversed and the end of the anvil lapped in the same manner.

Leather Belting Is Now Sold By Thickness

The American Leather Belting Association has decided that for the greater protection of the consumers of leather belting, it should establish and sell this commodity by specifications of thickness instead of weight, thereby discarding the old weight terminology of "ounces per square foot" which may be varied by the mere addition of weighting materials to the leather, and does not necessarily always represent a differential in transmission values.

This is an interesting and progressive move for the purpose of establishing higher standards for a product that has been sold by weight for many years. Inasmuch as leather belting prices are based on thickness, the simplicity and common sense of this change has met with the instant approval of both manufacturers and users of leather belting. It simplifies and makes comparatively easy the checking of each piece of belting to see if the average thickness is as ordered.

The thickness specifications now in effect for first quality leather belting are as follows:

Medium Single10/64 in. to 12/64 in.
Heavy Single12/64 in. to 14/64 in.
Light Double15/64 in. to 17/64 in.
Medium Double18/64 in. to 20/64 in.
Heavy Double21/64 in. to 23/64 in.

1. All thicknesses in this table are average thicknesses in inches, and should be determined by measuring 20 coils and dividing this value by the number of coils measured. In rolls of belting containing less than 20 coils the average thickness should be determined by meas-

uring one-half of the total number of coils and dividing this value by the number of coils measured.

2. The classification of "Light Single" has been eliminated entirely.

3. Uniformity: No point in either single or double belting shall be more than 2/64 in. thicker or more than 2/64 in. thinner than the average thickness.

4. The second and third quality brands of each manufacturer bear the same relative thickness to the manufacturer's first quality grades as they did in the past under the old "ounces per square foot" specification.

These thicknesses are now in effect and should be used by all buyers of belting in wording their orders. Every order for single or double should specify the thickness on the order. If just the words "Light," "Medium," or "Heavy" appear on the order these words now mean the thickness as per the above table and not the weight.

"Production Welding"

"Production Welding" is the title of a pamphlet which illustrates and describes in a vivid manner the application of the oxy-acetylene process in a number of the more important industries. Engineers, superintendents, executives, and others interested in work of a productive nature will find many constructive ideas in this small volume.

The first section of the pamphlet is devoted to an explanation and description of the facilities necessary for production welding, and points out the advantages derived. The latter section discusses the application of production welding in the automotive industry, refrigeration field, the fabrication of metal furniture and sheet metal products, the aircraft industry, the fabrication of pressure vessels, building construction, and pipe line work. The pamphlet can be had upon application to The Linde Air Products Co., 32 East Forty-Second Street, New York, N. Y.

Erratum

We have been informed that the milling machine referred to by A. E. Granville in "Cutting Turbine Blades from a Solid Casting," published in the June issue of MODERN MACHINE SHOP, was a Knight Vertical Miller, made by W. B. Knight Machinery Co., St. Louis, Missouri.

INVESTIGATE



the PULLMORE

*An Improved Clutch, for
Improving Machine Performance*

Check into these features: **EFFICIENCY
COMPACTNESS
ADAPTABILITY**

Submit your clutch problem for the consideration of our Engineering Department. No obligation.

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*Do you have
little Holes to
Grind?*

LET Chicago Mounted Grinding Wheels help. They go to the bottom of blind holes as well as clear through open holes of any depth.

They grind formed holes as well as straight—and any size from .050" up.

They cut anything. They're always ready, run either way and wear clear to the shank.

Ask for catalog showing hundreds of sizes, shapes and kinds.



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Over the Editor's Desk

Now Is the Time---

THE present business depression is the ninth through which this country has passed since the Civil War. In each case, the men who emerged from the cycle with wealth and power were those who foresaw the possibilities and took advantage of them. The time to buy is when everyone else wants to sell. The time for action is when everyone else is sitting about in the stupor of despair, lamenting the present and oblivious to the future.

The human race is not going to die out with this generation, nor has human intelligence dwindled with the price of stocks. This depression will end—next week, next month, or some other time—but end it will and then the mad rush will be on to fill the needs of a destitute world. People need clothes, furniture, utensils, cars, trucks, household equipment, office equipment, machinery, tools, and what not. As confidence returns in the minds of the people, buying will be resumed; slowly and cautiously at the first, but with increasing momentum as the increase in the circulation of money becomes evident.

Now is the time for planning; now is the time to prepare for the next cycle of prosperity by laying out the steps that can be taken to bring the plant to its highest point of efficiency. Time devoted to a study of the individual pieces of plant equipment, location, tooling, and so on, and to the possibilities for improvement that might lie in rearrangement or in retooling, is time well spent. Plans should be made for replacing worn-out tools; worn-out machine parts, worn-out belts, worn-out pumps, and

other equipment. Designs can be drawn up for stock bins and racks that will keep material off the floor and thus reduce waste, prevent damage to finished parts, and add to the appearance and general efficiency of the plant.

The productiveness of mechanical equipment can be increased materially by arranging to have stock and tools delivered at the machines. Spindles can be kept running by having duplicate tools, placing all grinding wheels in the tool cribs, and requiring all tools to be ground by operators especially trained for that particular purpose.

In plants where the work is of a repetitive nature, a study should be made of the possibilities for wage payment upon a task basis. Many shops are still paying upon a day-work basis, due either to plain inertia on the part of the managing executive, or to a lack of knowledge of the proper methods to be used in installing a wage incentive system. The benefits of task payment—piece-work, bonus, or whatever—are too important to be overlooked. The truth of this statement is evidenced by the fact that no plant that ever adopted a task payment system has — unless the circumstances changed — gone back to the day-work system.

An earlier issue of *Modern Machine Shop* carried an article in which complete instructions were given for making time studies to be used as a basis for a task wage payment system. Another issue of this magazine carried an article which described, in detail, how to go about the task of making a "paper" plant layout. Copies of these articles will be gladly sent to plant executives upon request.



"Alnor"

MODEL 223

PYROMETER

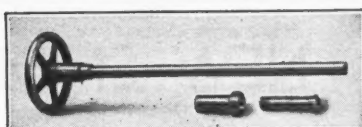
For the Hardening Furnace

Price complete with-out protection tube

\$35

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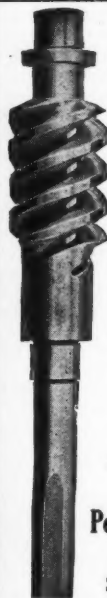
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Collet Attachments for your lathes and millers

Write for new Bulletin No. 100 A.M.—Rivett Draw-In Collets and Chucks. Also Price List and Dimension Sheet.

Rivett Lathe & Grinder Corp.
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QUALITY worms and gears are essential for the perfect functioning of your products. PERKINS Ground Thread Worms are correctly hardened, accurately ground, and finely polished to insure lasting quality.

It is good business to use good gears — PERKINS Gears—gears that provide highest economy in your manufacturing program.

SEND YOUR BLUEPRINTS
FOR ESTIMATES.

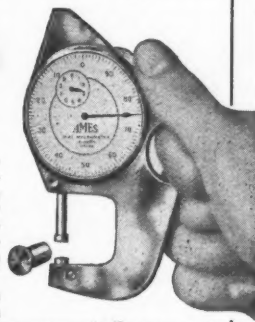
Perkins Machine & Gear Co.
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Accuracy and Speed with the

AMES "Dial Mike"

Speedier to use—easier to read—extremely accurate—that's why this modern dial-reading micrometer replaces the old style "mike."

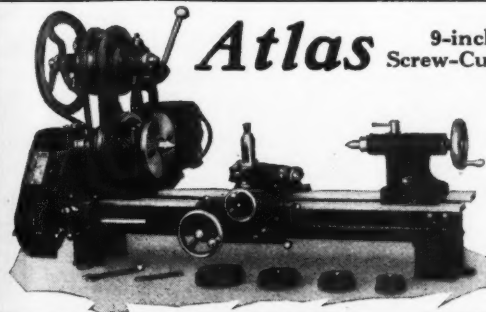
Simply move the thumb to open the anvils. Closes automatically onto part being measured. Spindle lock makes it an adjustable snap gauge if desired. Capacity, 1".



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KALAMAZOO MICHIGAN

NEW SHOP EQUIPMENT

Natco Special Vertical Hydraulic Driller

The vertical hydraulic drilling machine shown in the illustration was built by The National Automatic Tool Company, Richmond, Ind., especially for drilling the tube holes in large express-type boiler drums. The machine is an adaption of the standard Natco Model D20H and is equipped with a semi-automatic hydraulic Oilgear feed arranged with the patented Natco safety foot control and emergency reverse.

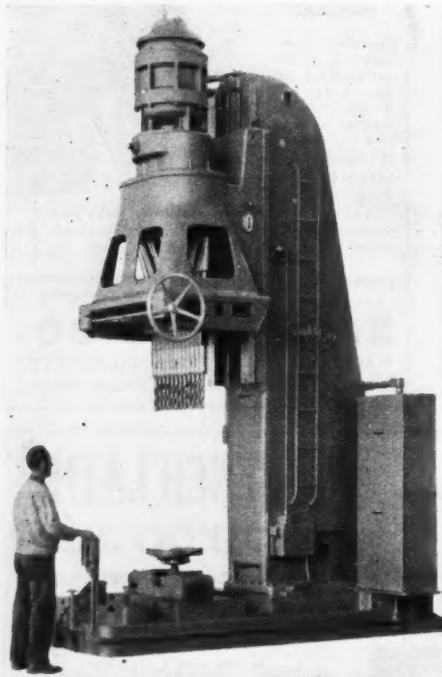
The machine is equipped with a 24 x 40-in. rectangular head bored for 16

spindles and is equipped with 12 three-inch diameter upper joint assemblies each having a single speed and neutral position. The head is equipped with roller bearings throughout.

Spindle equipment consists of a special adjustable bearing plate arranged for and complete with 12 spindles of 2½ in. dia., with No. 4 Morse taper and nose adjustment. The spindles are held in a straight line parallel to the ways on the column, and have a horizontal adjustment toward and away from the column of 14 in., the minimum and maximum distance being 22 in. and 36 in. respectively.

The base is provided with two rectangular slots, running left to right, of the proper depth to insert a No. 75 rail. The slots are spaced to permit a 36-in. center-to-center spacing of the rails under the center of the head. Coolant channels are provided in the base, with a coolant reservoir within the base and at the rear. The coolant is supplied to the work by means of a motor driven pump, through a valve that is controlled by the movement of the head. Mounted on the base is an air-operated jack that supports the drums while they are being drilled.

The machine weighs approximately 38,000 lb., and has a drilling capacity of twelve 1½-in. drills in steel at a heavy feed. It is approximately 16 ft. in height.



Natco Special Vertical Hydraulic Driller

Morton 40-In. Stroke Special Draw-Cut Flash Trimming Machine

The machine shown in the illustration has been developed by the Morton Manufacturing Company, Hoyt and Broadway, Muskegon Heights, Michigan, for the accurate removal of the flash or upset from butt-welded or flash-welded tanks and sheets. The easy entrance and quick removal of work which are essential to high production have been of first con-

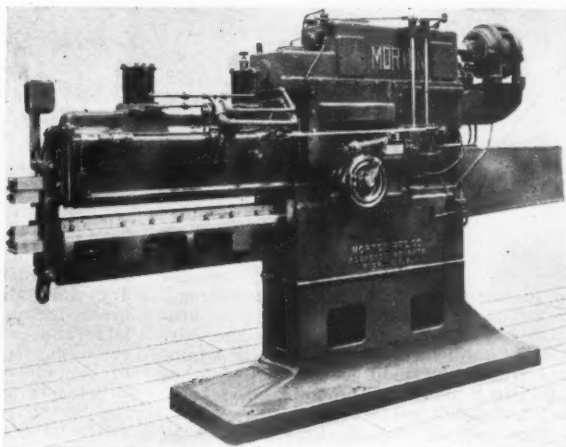
sideration. The machine is provided with a 2-in. clearance between the rams at time of loading and unloading so that any condition of warpage is readily taken care of.

The column is of box type and is heavily constructed. All journals are closely fitted and bolted, insuring perfect alignment and rigidity. The base is of sufficient length to insure against undue vibration. The main driving pinion is cut from a solid steel forging, and steel gears are used in all places that are subject to heavy cutting strains. They are enclosed in dust-tight compartments and run in oil. Shafts are of high grade steel, finish ground after keyseating.

The ram, which is of steel, is of special construction and of sufficient length to provide 40 inches of cutting stroke. It is made in two sections in the form of a letter "T," to remove the flash from both sides of the work at the same time. The upper section is carried in a guideway which can be moved vertically, and which also forms the base for securing the upper clamping jaw. The vertical movement is accomplished by means of air cylinders working over compounding leverages so that sufficient pressure is obtained for securely straightening and clamping the work. Thus one of the essentials for close stripping is taken care of by automatically compensating for variation in the thickness of the stock. The lower ram section is carried in a solid guide-way with the proper provision for lubrication and is so constructed that all of the trimmings that are removed from the inside of the drum drop through free openings and are carried either forward or back. Bearings are arranged so that the sections are equally supported throughout the length of the stroke. Each ram is slotted for multiple special tool holders, with tools that are independently adjustable for regulating the depth of the cut and for operating position.

The lower bearing and ram are supported in an extension having a bearing on the lower side. Adequate bearing

surface is provided together with an opening to permit adjustment of the lower cutting tools. Strips of steel, of widths and lengths to accommodate work to the capacity of the machine, are located on the upper side. A quick-act-



Morton Flash Trimming Machine

ing cam locking device securely ties the upper and lower supporting frames while the cut is in process.

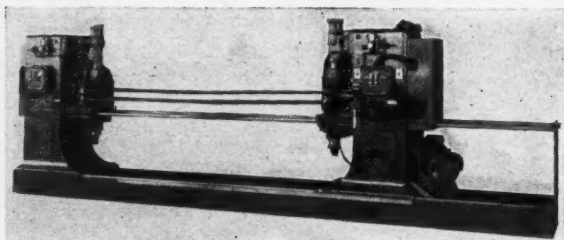
The reciprocating motion of the ram is obtained by friction clutches of special design, made with compound discs, and running in oil. All adjustments are easily made, and the stroke can be adjusted while the machine is in motion. The electric drive may be connected to drive the machine direct through a coupling, or through a cog belt.

The working stroke is 40 in., and the distance between center of rams and floor is 42 in. Ratio of gearing, 15.53-1. Motor, 5 h.p.; 1200 r.p.m. for constant speed, or 750 to 1500 r.p.m. variable speed. Actual floor space, 3 x 14 ft. Operating space required, 15 x 14 feet.

Thomson-Gibb Electric Heating Machine

To facilitate the rapid soldering of flanged fins to copper tubes, a special application of direct controlled heating by the electric resistance method was made in a machine that has been developed by Thomson-Gibb Electric Weld-

ing Co., Bay City, Michigan. The machine takes from three to twelve tubes, on which are assembled a large number of flanged fins, each of which must be soldered to each tube for good thermal



Thomson-Gibb Electric Heating Machine

contact. The tubes are first covered with solder, then the fins are assembled, soldering acid applied, the complete unit clamped in the machine, and the current is applied. In approximately a minute, depending upon the number of tubes and their lengths, the entire assembly is thoroughly soldered.

One unit of the machine is fixed at the end of the base; the other is adjustable through a distance of 10 ft., being controlled by means of a motor-driven worm reduction unit, spur gears, and rack, the motor having a reversible drum control. Adjustable time relays provide for control of the heating time. The work is clamped by means of adjustable air-operated jaws.

Each unit of the machine carries its own transformer, one side of the secondary being connected to heavy bus bars, the work forming the other side of the secondaries. This method of direct controlled heating by electrical resistance may also be applied to heating for annealing, heating for forging, and similar classes of work.

Porter-Cable 2nd Series Carbo-Lathe

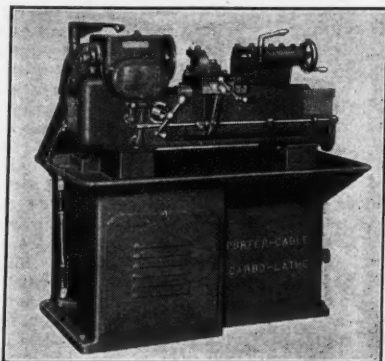
The 2nd Series Carbo-Lathe, which is being offered by the Porter-Cable Machine Co., Syracuse, N. Y., is similar in design to the 1st series Carbo-Lathe, but a number of improvements have been added that are intended to make the lathe much more adaptable for the use of tungsten and tantalum carbide tools. The bed and headstock have been strengthened by heavier ribbing, in-

creased wall thickness, and larger fillets. The weight of the machine has been increased about 100 lb. Great tensile strength and wearing qualities are guaranteed by the use of fine chrome nickel iron. As formerly, the center of the bed is hollow so that the chips can fall through.

Front and rear bed ways are identical, and two carriages can be used at the same time—one in front and one in rear. The tailstock is heavier and of two-piece construction. An adjusting screw provides for proper alignment between centers.

The drive is from a motor concealed in the base to a single plate dry disc clutch which also carries a brake for quick stopping. If desired, the lathe can be driven from countershaft by removing two small covers from the top of the clutch guard, allowing the belt to pass through the guard directly onto the clutch pulley. The spindle pick-off gears have been widened to $1\frac{1}{2}$ in., and the form gear now comes in two ratios; the low gear with a ratio of $3\frac{1}{2} : 1$ and the high gear with a $2 : 1$ ratio.

Spindle speeds obtained with an 1800 r.p.m. motor and low geared head are 95 to 1130, with feeds of .005, .010, .015, .020, .025, and .030 in. With high geared head the speeds are 170 to 2000 r.p.m.



Porter-Cable 2nd Series Carbo-Lathe

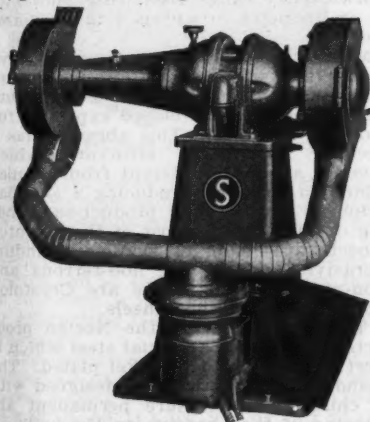
and the feeds are .003, .006, .010, .013, .016, .020 and .025 in. Variable speed motors will furnish an even wider range of speeds.

Work 7 in. dia. by 18 in. long can be turned, or short chuck work up to 12 in. dia. can be handled. The base and chip pan are much larger, and a coolant tank is cast into the base. A hinge plate is provided for the motor, with turnbuckle adjustment on the outside of the base for correcting belt tension. The weight of the machine has been increased about 50 pounds. In keeping with the rest of the machine, the principal attachments have also been redesigned for greater strength and improved operation.

"Standard" Motor-Driven Exhaust Blower

The Standard Electrical Tool Co., 1940 West Eighth Street, Cincinnati, Ohio, announces a motor-driven exhaust unit which may be mounted on any of this company's heavy duty grinders or buffers.

The illustration shows the Standard Combination Grinding and Buffing Machine equipped with 3 h.p. motor, both the grinder and buffer sides of the machine being fitted with enclosed hinged door guards, each with exhaust outlet. On the back of the pedestal is mounted a $\frac{3}{4}$ h.p. 3600 r.p.m. motor driven exhaust unit fitted with a dust collecting bag. The net weight of the machine is

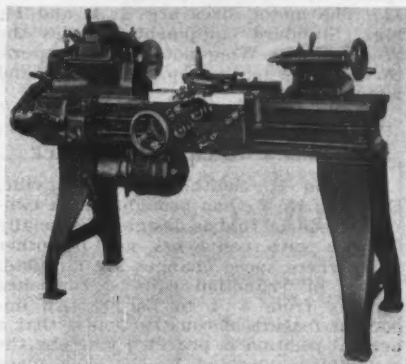


Standard Combination Grinding and Buffing Machine Equipped with Motor-Driven Exhaust Blower.

846 pounds. The use of the exhaust blower eliminates the necessity of installing an elaborate exhaust system, and provides a complete assembled unit in itself.

Special Rockford Economy Lathe

To meet the demand for a first class, accurate, powerful, and durable engine lathe for standard work, the Rockford Machine Tool Co., 2414 Kishwaukee Street, Rockford, Ill., has brought out



Special Rockford Economy Lathe

the "Special Rockford Economy Lathe" shown in the illustration. The machine is entirely self-contained, being equipped with a built-in Westinghouse-Wise 4-speed motor drive and controller.

The lathe is heavily built, in accordance with the requirements of modern cutting tools, and all parts are easily accessible. The drive is mounted underneath the lathe bed, completely protected from dirt and chips but out of the way. A silent chain transmits power to the headstock spindle. The transmission is so constructed that it cushions the starting movement and provides a safety overload factor for the chain. The controller starts, stops, or reverses the spindle.

By moving a crank, the spindle speeds can be changed easily and quickly and without stopping the motor. Back gears provide a double range of speed. Any one of 32 thread-leads or feeds is secured instantly by shifting gears, and additional leads and feeds are available by changing the quadrant gears. A thread-cutting dial is standard equipment.

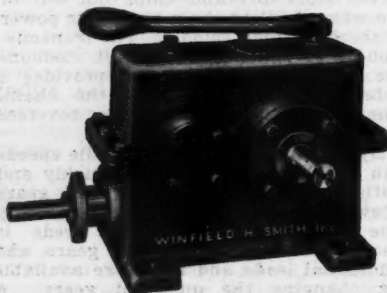
A compound cross-slide of compact design is mounted on the extra wide, heavy bridge. The leadscrew is of large diameter, is highly accurate, and has a continuous thread with no spline. An independent feed shaft with interlocking safety clutch is provided.

The sizes as rated are $13\frac{1}{4}$ in., $14\frac{1}{2}$ in., and $17\frac{1}{4}$ in. swing, the swing over the carriage for the several sizes being, respectively, 6% in., 8 in., and 11 in. The spindle speed ranges for the three sizes are 22 to 600, 20 to 600, and 15 to 580 r.p.m., the smallest size having 8 spindle speeds, and the other two sizes, 12. The motor sizes are $\frac{3}{4}$, 1, and $1\frac{1}{2}$ h.p. Standard equipment includes the Westinghouse-Wise motor drive, centers, thread dial, depth stop, face plate, and wrenches.

W H S Two-Speed Reducer

Winfield H. Smith, Inc., Springville, Erie Co., N. Y., has brought out a two-speed reducer that is designed especially for use with conveyors and on other units where speed changes are required. Ratios of reduction can be furnished ranging from 4:1 to 150:1. An important feature of construction is that a neutral position is provided whereby the mechanism operated by the slow speed shaft can be stopped without cutting off the power to the unit.

The reduced has a hardened steel worm on the high speed shaft, driving a special alloy bronze worm gear mounted on the intermediate shaft. On this shaft are also two spur gears which are in constant mesh with two spur gears of special alloy metal that are mounted on the slow speed shaft. The drive is taken by means of a clutch engaging with one of the spur gears on the slow speed shaft. This clutch is actuated by a yoke arm

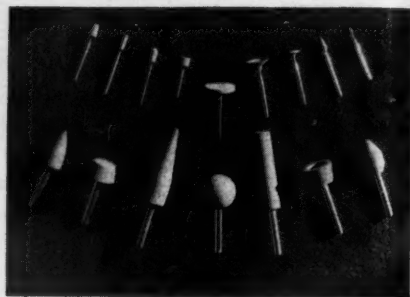


W H S Two-Speed Reducer

that extends through the top of the reducer. The clutch can be shifted easily from slow speed to high speed operation or to neutral position while operating under full load.

Norton Mounted Abrasive Wheels, Points, Pencils, and Buttons

Continued success in tests with experimental mounted wheels, points, pencils, buttons and other shapes has led Norton Company to develop a complete line of these modern machine shop tools



Norton Mounted Abrasive Wheels, Points, Pencils, and Buttons.

of specific and well-suited abrasives and bonds. The line includes more than 100 different shapes which can be used on any of the standard machines for this work. They range from tiny points $\frac{1}{8}$ in. in diameter to wheels 1 in. in diameter.

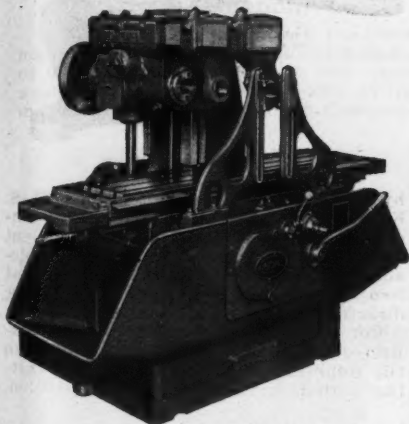
Most of the Norton mounted abrasive products are made with 38 Alundum abrasive, a patented brand of aluminum oxide which was developed expressly for tool and die work. This abrasive has a peculiar crystalline structure which gives it a temper different from regular Alundum abrasive, producing a singular grinding action. For production grinding of small holes, most of the mounted wheels are made of regular Alundum abrasive, and for the non-ferrous and non-metallic fields there are Crystolon abrasive points and wheels.

The spindles on all the Norton products are made of a special steel which is first copper and then nickel plated. The spindle tip is knurled and designed with a chisel end to insure permanent anchoring of the abrasive on the quill. A special cement of exceptional strength is used. Generally speaking, the Norton points and wheels are made with vitreous bonds—some of them of the new patented "B-Bond"—but there also are Bakelite-bonded points or wheels for specific purposes.

Sundstrand 3-B Rigidmil

The No. 3-B Rigidmil, which has been added to the line of Rigidmils made by Sundstrand Machine Tool Co., Rockford, Ill., is larger and heavier than the other sizes of this machine, and has a number of features which are absent on the others.

The frame casting is larger and heavier, and has a welded steel extension to keep chips and coolant off the floor. The spindle head has been improved and a special high speed drive can be applied to the standard head at any time. The designs of the quill adjustment and grease retainers are all new and the elevating screw is heavier.



Sundstrand No. 3-B Rigidmil

The feed screw is of new design, and a special anti-backlash nut is available as extra equipment. Tool trays are provided at each end of the table. A reciprocating table in 6 lengths and 2 widths can be supplied, or a rotary table in two sizes with either continuous feed or alternating feed with automatic rapid traverse.

The machine can be supplied with table feed of from 24 in. to 60 in., with tables having working surfaces of from 14 x 52 in. to 14 x 100 in., or 18 x 88 in., according to the feed. Number of feeds, 50. The ranges of spindle speeds are 17 to 241 as regular, up to 47 to 668 in the high speed range. From the center of the spindle to the top of the table, min., is 3½ in. Max., 16 in. Center of spindle to under side of overarm, 7 in. Motor, 5 to 10 h.p., 1200 r.p.m. Speed of drive

shaft, 400 r.p.m. Overall height of machine, 62 in. Floor space, 48 x 71 in. in one size and 52 x 71 in the other.

B & S Micrometer Uses Tungsten Carbide

Brown & Sharpe Mfg. Co., Providence, R. I., announces that the one-inch micrometer made in several styles by this company can now be had with the ends of the spindle and anvil faced with tungsten carbide. Micrometers so faced



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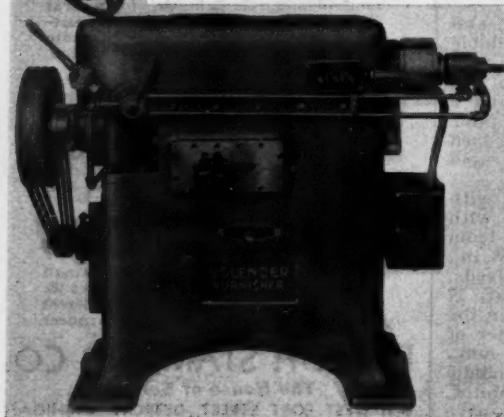
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will be especially useful in places where they are subject to unusual wear. The many styles in which the one-inch micrometer is made makes it possible to select the tool best suited for the work in hand. This company is prepared, also, to furnish other micrometer callipers with tungsten carbide faces.

Bolender No. 1 Semi-Automatic Gear Burnisher

The illustration shows two views of the Bolender No. 1 Semi-Automatic Gear Burnisher, which is now being marketed by City Machine & Tool Works, June and East Third Streets, Dayton, Ohio. This model has practically all the features of the larger models of this machine, with the exception that it is smaller in size and is not fully automatic. The burnishing pressure is exerted horizontally to the center of the master burnishers; flat gear mounting avoids overhang, and the burnishing pressure can be varied in the same manner as in the large machines. In this machine, however, the burnishing pressure is controlled through a three-button switch which permits the operator to burnish the work in one direction, reverse, and stop it to end the operation.

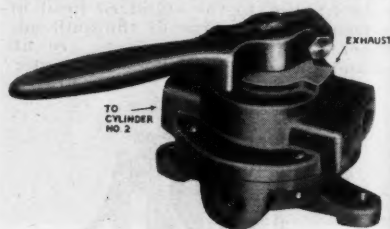
Although the machine as shown is air-equipped, it can also be furnished with the hydraulic unit. A built-in coolant system and Timken bearings are standard equipment. The ma-



chine handles both spur and helical gears up to 8½ in. diameter. The smaller size and absence of fully automatic control is intended to make possible a saving to users whose production needs do not justify the purchase of a larger, fully automatic model.

Hannifin Duplex Valve

A duplex air control valve, designed for use on machines where two air cylinders are employed, operating in progressive sequence, has been announced

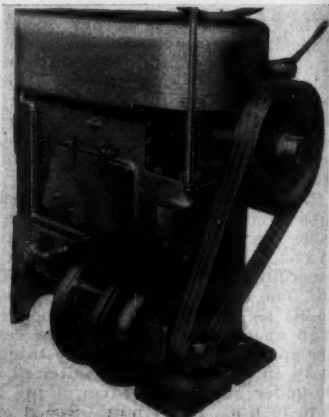


Hannifin Duplex Valve

by Hannifin Manufacturing Co., 625 S. Kolmar Avenue, Chicago, Ill. The Hannifin Duplex Valve has four independent outlet ports for control of two double-acting cylinders, and is so designed that two cylinders can be operated in either direction and in any sequence desired.

For example, the valve can be connected with two cylinders resulting in the following order of operation: Starting with lever at one extreme position,

Bolender No. 1 Semi-Automatic Gear Burnisher.



then moving the lever 45 deg. causes the piston of No. 1 cylinder to move forward; moving the lever an additional 45 deg. causes the piston of No. 2 cylinder to move forward; moving the lever back 45 deg. reverses cylinder No. 2, and moving lever to original position reverses No. 1 cylinder.

The Hannifin Duplex Valve embodies all of the features of the standard Hannifin "Packless" valves and is furnished in two sizes; Model D-37, with $\frac{3}{8}$ -in. I. P. connections, and Model D-75 with $\frac{1}{2}$ -in. I. P. connections.

Barcol Midget Motor With Shading Coils Provides Two-Way Rotation

The Barcol Midget Motor, a fractional horsepower single-phase induction motor of the shaded pole type, is now made available in a reversing model by its manufacturer, Barber-Colman Company,



Barcol Midget Motor

Rockford, Ill. Unidirectional models previously announced have made use of shading rings to introduce a delay in part of the field surrounding the rotor and thus to obtain a rotating field which would produce motor action. This new reversing model of the Barcol Midget Motor employs shading coils in place of the shading rings of the other models, and the motor is connected with current on the main field coil all the time, no rotation being produced until a current is sent through one or the other of the

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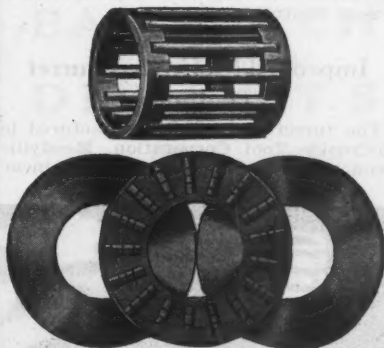
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two sets of shading coils. Direction of rotation is determined by which of the two sets of shading coils is energized.

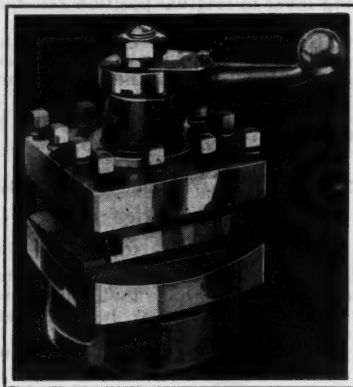
The construction of this reversing motor is much the same as the other models, with the exception of the wound coils which are used in place of the solid copper rings. These coils are made the same as the main field coil, of high grade enameled wire on a phenolic resin spool and impregnated with moisture-proof varnish. The leads, as can be seen in the illustration, are brought out to plates mounted above the coils and control leads as required are taken off from these plates. In all other respects—the main field coil, the field laminations and stator construction, the construction of the rotor, the type of bearings used, the bearing plates, and the method of assembly—the reversing model is identical with the unidirectional type.

The reversing model has the same general advantages which characterize all Barcol Midget Motors, namely, high starting torque, high power considering the size of the motor, and relatively high efficiency. This model is available in several sizes to suit various applications and will be found in such devices as damper controllers, valve motor-operators, heat regulators, pumps, radio remote control, and so on.

Improved McCrosky Turret Toolposts

The turret toolposts manufactured by McCrosky Tool Corporation, Meadville, Penna., have been redesigned to incor-

porate several important improvements. The fundamental feature of the indexing mechanism has been retained. A corrugated bearing surface on the under side of the turret body meshes with compli-



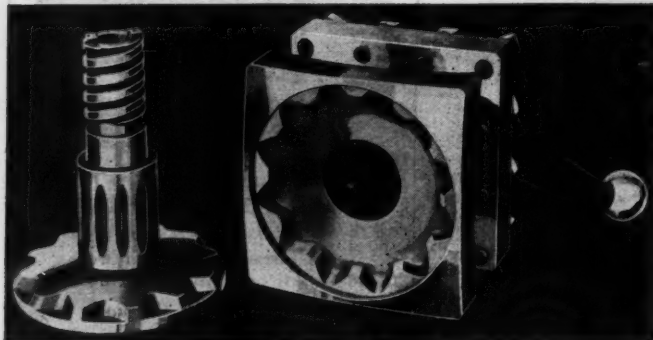
McCrosky Type L Turret, for bolting to bolt-circle of compound rest.

mentary corrugations on the stationary base of the turret column, this mechanism providing for 12 indexing positions.

In the new design the stem of the turret column is encased in a hardened steel sleeve that has 12 vertical grooves in exact axial relation to the 12 indexing positions. In the hole of the turret body that receives the stem of the column are two spring plungers, opposite each other, that engage the grooves. The ratchet effect produced by these parts

is a distinct aid to rapid indexing when positioning a tool.

The clamping handle of the turret has been redesigned to conform to the usual types of levers and handles, and has been fitted with a spring plunger that rides against a cam attached to the top of the turret column. The cam has a right angle recess. When the handle is in



Disassembled view of McCrosky Improved Turret, showing details of indexing mechanism.

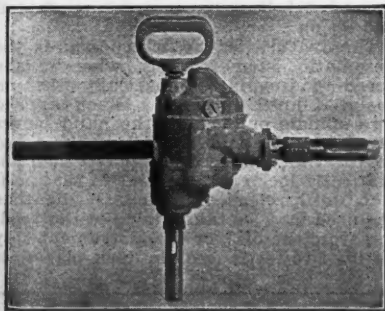
closed position, the plunger presses against the recess and locks the turret rigidly in place.

When the operator wishes to rotate the turret, he pushes the handle away from him a quarter turn, using steady pressure. The movement of the handle carries the plungers out of the recess and raises the turret until it clears the corrugations. The turret can then be turned freely, after which a steady pull on the handle locks the turret in position.

Ample lubrication of all moving parts has been provided for and the handle has a dust collar to prevent dirt from working in between the handle and the body. A skirt on the body prevents chips from working in between the corrugated surfaces of the indexing mechanism. The improved turret is made in five standard styles, to fit practically any type of lathe.

C. P. No. 315 Rotary Drill

The Chicago Pneumatic Tool Co., 6 East 44th Street, New York, N. Y., has brought out a rotary drill known as the No. 315, available in various sizes and either reversible or non-reversible. The drill is a "power vane" tool, designed so that it employs neither pistons, toggles, nor crankshaft. It is said to be



Chicago Pneumatic No. 315 Rotary Drill

exceptionally powerful for its unusually light weight, and is suitable for general purpose drilling and reaming, tapping, and so on, particularly in close quarters.

The "power vane" construction eliminates "dead spots" in any position of the tool or rotor, and the tool has the same power in either forward or reverse. The throttle handle is equipped with a safety lock that positively prevents

change in direction of rotation unless this lock is released.

The drill is designed for perfect balance, to eliminate vibration. Ball bearings are used throughout, and the cylinder is provided with a replaceable liner of hardened steel. Complete lubrication for the motor is effected by a line oiler located in the housing. Grease fittings are provided on the gear and governor cases. A governor control is provided on the intake air supply, maintaining free speed, reducing air consumption on the power side and back pressure on the exhaust side. The small



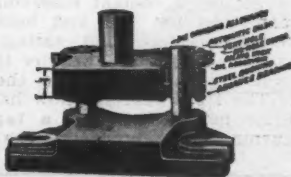
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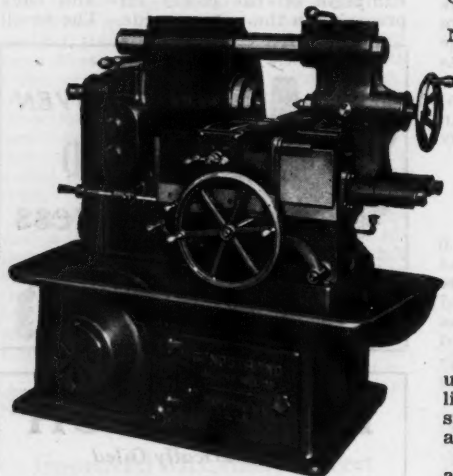
E. A. Baumbach Mfg. Co.
1806 S. Kilbourne Ave. Chicago, Ill.

spindle offset permits ease of operation in close quarters.

Either tool can be provided in four sizes, from $\frac{1}{2}$ in. to $\frac{3}{4}$ in. capacity for drilling in steel.

Sundstrand 8-In. Stub Lathe

The "Stub" Lathe, which is a product of Sundstrand Machine Tool Co., Rockford, Ill., is now available in the 8-in. size. The base contains a compartment



Sundstrand 8-in. Stub Lathe

for the motor, a coolant reservoir, and chip pan, and the bed and headstock comprise a one-piece rigid casting. The front slide is larger and heavier than in the smaller sizes, as is also the tailstock. The front carriage now has provision for mounting either a taper or form-turning attachment. The rear

slide is stronger and has a new in-and-out adjustment.

The machine is designed so that the carriage can pass the headstock. The swing over the carriage is $11\frac{1}{2}$ in., and the swing over the rear slide is 11 in. Swing over the front slide is $7\frac{1}{2}$ in. Maximum capacity between centers, $10\frac{1}{2}$ in. Number of spindle speeds, 12. Range of spindle speeds, standard, 40 to 265 r.p.m. Range at 3 to 1 ratio, 75 to 490 r.p.m. Range with special "Hour Glass" drive, 155 to 1020 r.p.m.

Extreme travel of carriage, 10 in. Number of feeds, 10. Range of feeds, 0.005 to 0.046 in. Maximum travel rear tool, 4 in. Distance floor to center of spindle, 45 in. Floor space, $60 \times 45\frac{1}{2}$ in. Motor recommended, 5 to $7\frac{1}{2}$ h.p., 1800 r.p.m. Net weight, without motor, 3625 pounds.

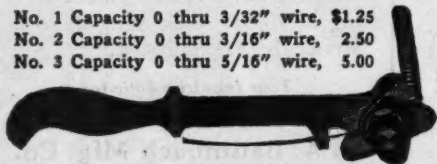
Amthor No. 350 Hand Tachometer

The Amthor Hand Tachometer, shown in the illustration, has been developed by Amthor Testing Instrument Co., Inc., 309 Johnson Street, Brooklyn, N. Y., for use in testing the speeds and fluctuations of such units as engine shafts, motors, blowers, line shafts, machine spindles, or surface speeds of belts, shaper or planer tables, and so on.

The feature of the instrument is the automatic fixed reading, whereby the speed reading is automatically fixed on the dial until released. When applied to a spindle or surface, the hand moves around to the point indicating the speed of the unit under test, and then automatically locks and remains in that position until released. Thus all the time required may be taken to take the reading from the dial, or the instrument may be used to test speeds in dark places, or

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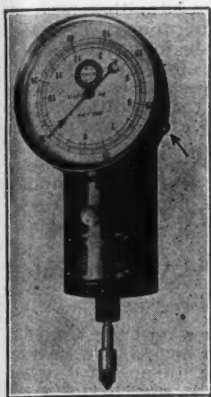
HJORTH LATHE & TOOL CO. 60 STATE ST. BOSTON, MASS.

in places where it is impossible to read the dial at the time the test is being made, such as in the

case of tall vertical spindle machines, overhead shafts, overhead belts, and so on.

The dial is graduated to read directly in r.p.m., but the instrument is equipped with all accessories so that "feet per minute" surface and belt speeds can be taken. The tachometer has four speed ranges, each of which is separately read over the entire circumference of the dial. Each

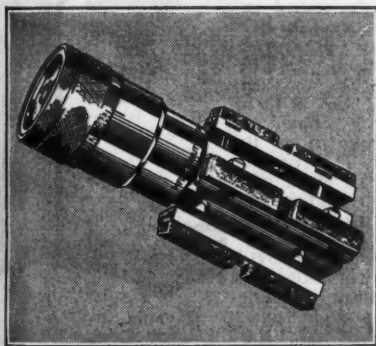
instrument is constructed with a finely-balanced cross pendulum governor movement, is hand calibrated for accuracy, and is dead beat in action. Various ranges are available to directly test any speeds to 12,000 r.p.m.



Amthor Hand Tachometer

Hutto Automatic Cylinder Grinder

An automatic cylinder grinding hone, so designed that it requires but one setting to grind all bores of a cylinder



Hutto Automatic Cylinder Grinder.

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gan. The tool expands automatically and the control limits the expansion to a predetermined diameter.

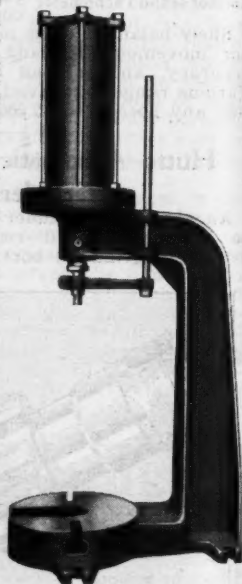
The tool can be used either wet or dry. There are four stones, especially fabricated to eliminate flying dust when dry grinding. The stones are easily and quickly replaced. Pressure on all stones is even throughout the operation. The tool is equipped with a telescope driving universal which can be extended to 19 in. in length. Any portable drill of half-inch size or larger will furnish ample power to operate the hone.

**Hannifin "A-1" Air Operated
Arbor Presses**

The Hannifin Manufacturing Co., 625 S. Kolmar Avenue, Chicago, Ill., is now putting out a line of air-operated arbor presses to be known as the "Series A-1." The presses in this series have been designed to meet the need for a direct-acting press with generous throat dimensions. The distance from the table to the ram is 11 in., and from the center of the ram to the back of the throat is 8 in.

The press can be furnished in five sizes to deliver pressures ranging from 565 lb. to 6280 lb., and with a any length of stroke up to 10 in. The frames in all sizes are of cast steel, thus assuring the necessary rigidity. Provision is made for guiding the ram to prevent turning, and the ram is supported in an extra long bearing. The presses will be furnished with either hand or pedal-controlled valves.

The cylinder bores for the five models are, respectively, 3 in., 4½ in., 6½ in.,

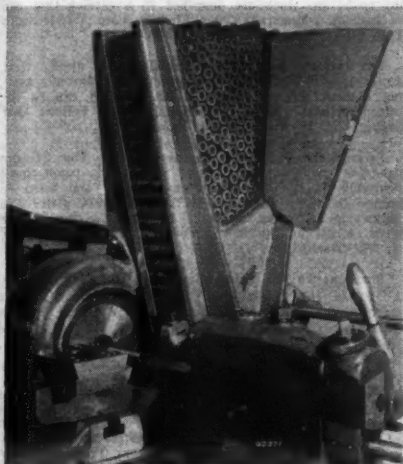


**Hannifin "A-1" Air-
Operated Arbor Press**

8 in., and 10 in., with power (at 80 pounds pressure) of 565 lb., 1,270 lb., 2,655 lb., 4,020 lb., and 6,280 lb. Ram strokes are as required.

Magazine for P. & W. 1 x 18-In. Full Automatic Lathe

The loading capacity of the Pratt & Whitney 1 x 18-in. Full Automatic Lathe can now be greatly increased by the use of the magazine shown in the illustration.



P & W Full Automatic Lathe Equipped With Magazine

tion. The magazine as illustrated is set up for cast iron automotive valve stem guides. A full load consists of 300 pieces, which represents approximately 75 minutes of work as the stems are machined in 15 seconds each.

The valve stem has an overall length of $3\frac{1}{8}$ in. and a turned diameter of $\frac{1}{8}$ in. The turned length is $2\frac{1}{4}$ in., and the ends are faced during the turning operation. This turning operation is followed by centerless grinding, 0.006 in. of stock being left on the diameter for this purpose.

By using the magazine shown, one operator can handle several more machines than with the smaller type of magazine, thus reducing labor costs 30 to 45 per cent. The magazine has a hinged door on one side to facilitate loading. The work is placed with corresponding

(Continued on page 54)

For YOUR Shop The Boston Universal Angle Plate



An accurate machine tool adaptable to all phases of machine work—miller, drill, planer and shaper.

1. Eliminates costly fixtures.
2. Decreases production costs.
3. Increases jobbing output.

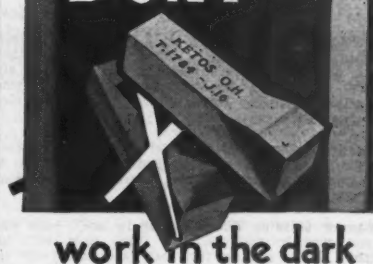
A rugged, practical machine tool that every machine shop will find a good investment.

Send for bulletin describing and illustrating the many uses of this precision tool.

U. S. AUTOMATIC BOX MACH'RY CO.

459 Watertown Street
NEWTONVILLE, BOSTON, MASS.

DON'T -



work in the dark

WHAT kind of steel is it? Is it oil hardening or water? What job is the tool for? What is the job number? Who made it?

These questions are answered economically and speedily if the article is properly marked.

Schwerdtle Steel Alphabet and Figure dies in sets, are designed for just such work as marking dies, tools, parts, and for all miscellaneous marking.

The simplest mistakes are the costliest, and the remedy for them is very inexpensive.

INSIST ON PLAIN, ADEQUATE LABELING OF TOOLS

THE SCHWERDTLE STAMP CO.

13 CANNON STREET BRIDGEPORT, CONN.

For Your Catalog Library

Check any of these useful publications that you want, write your name, firm name, title, and address on the margin, then tear out the page and send to Modern Machine Shop, 128 Opera Place, Cincinnati, Ohio. They will be forwarded to you promptly without cost or obligation. Please restrict your list to not more than ten.

Chucks—Key and Keyless: Bulletin No. 120A, issued by T. R. Almond Mfg. Co., Ashburnham, Mass., describes and illustrates the line of key and keyless geared nut and ball bearing drill chucks made by this firm. Copy free upon request.

Ames Gages: Catalog No. 50, issued by the B. C. Ames Company, Waltham, Mass., contains complete descriptions and illustrations of the dial gages, gage heads, upright gages, cylinder gages, dial micrometers, and precision verifiers, special gages and attachments made by this company. Copy free upon request.

Machine Shop Accessories: Catalog B-37, issued by the Armstrong Bros. Tool Co., 328 N. Francisco Ave., Chicago, Ill., describes the line of tool holders, boring tools, wrenches, pipe tools, ratchet drills, lathe dogs, and other tools manufactured by this company.

"Atlas" Bench Lathe: A 9-in., screw cutting, self-contained, motor-driven bench lathe is now being built by Atlas Press Co., Kalamazoo, Mich. Write for circular.

Greenard Arbor Presses: Catalog No. 36, issued by the Edwin E. Bartlett Co., Nashua, N. H., describes and illustrates all the various types and sizes of arbor presses made by this firm. Copy free upon request.

Drop Forged Steel Die Sets: The economy and other advantages of drop forged steel die sets, which are now being made by E. A. Baumbach Manfg. Co., 1806 South Kilbourn Avenue, Chicago, Ill., are explained in a folder that can be had by addressing this firm.

Carboloy Tools: Handbook M32, issued by Carboloy Company, Inc., 2485 East Grand Boulevard, Detroit, Mich., describes the tools made by this firm, and also includes information regarding manufacturing, brazing, and grinding Carboloy tools. Copies free to mechanical executives.

Abrasives: Samples of "Aloxite" Brand "TP" Polishing Grains for trial may be had without charge by addressing the Carborundum Co., Aloxite Division, Niagara Falls, N. Y.

Mounted Grinding Wheels for use in small holes such as are found in bushings, dies, gears, tools, etc., are described in a catalog that has been issued by the Chicago Wheel & Manfg. Co., 110 S. Aberdeen St., Chicago, Ill. Copy free upon request.

Motorize Your Cone Pulley Lathes: An attachment that can be applied to your lathe with four bolts makes it possible to motorize and modernize your lathes. Write for information to Cullman Wheel Co., 1336 Altgeld St., Chicago, Ill.

Die Makers' Supplies: A complete line of die sets, leader pins, bushings, and other die makers' supplies are described in a book that is issued by the Dandy Machine Specialties, Inc., 2104 South 52nd Avenue, Chicago, Ill. Sent free upon request.

Steel Spacing Washers: Milling jobs can be set up quicker by using standard spacing washers, made by

Detroit Stamping Co., 3445 West Fort Street, Detroit, Michigan. Write for information.

"Speed" Spot Welders for welding metals from 0.0005 in. to $\frac{5}{8}$ in. thick are described in a catalog that can be had by addressing Elser Electric Corp., 761 South 13th Street, Newark, N. J.

The Involute Gear Simply Explained: A direct, clear explanation of the theory and principles of involute gearing without the use of higher mathematics can be obtained without charge by addressing The Fellows Gear Shaper Co., 78 River St., Springfield, Vt.

Performance Data On Swiss Jig Boring: This 36-page pamphlet shows various types of jobs from a power shovel turntable jig to a television disc, drilled and bored on Societe Genevoise High Speed Precision Boring, giving data as to size of holes, accuracy and time savings. Free upon request to The R. Y. Ferner Co., 1008 K Street, N. W., Washington, D. C.

Questions To Ask Before Buying a Jig-Boring Machine: A list of the fine points to look for in a jig-boring machine, with descriptions and illustrations of the working parts of the Swiss Jig Borer, can be obtained free by addressing The R. Y. Ferner Co., 1511 K St., N. W., Washington, D. C.

Formica Silent Composition Gears: A booklet telling about the uses and advantages of Formica Silent Shock Absorbing Gears, and containing a considerable amount of valuable data with rules and tables for laying out, cutting and using gears. Sent free by Formica Insulation Co., 4632 Spring Grove Avenue, Cincinnati, Ohio.

Stampings of any kind or size can be obtained from Gerding Brothers, 5 East Third Street, Cincinnati, Ohio. Write for particulars.

Ball and Roller Bearings, either journal or thrust, for all purposes and in all sizes, are described and illustrated in catalog No. 9 which has been issued by The Gwilliam Company, 360 Furman Street, Brooklyn, N. Y. Copy free upon request.

Precision Bench Lathe Work can only be done on finely-built, accurate machines. The complete line of Horth Precision Bench Lathes is described and illustrated in a catalog that has been issued by Horth Lathe & Tool Company, 60 State Street, Boston, Mass. Copy free upon request.

Pyrometers: Inexpensive portable and stationary, single unit and multi-circuit pyrometers are described in a catalog issued by Illinois Testing Laboratories, Inc., 146 West Austin Avenue, Chicago, Ill. Copy free upon request.

Special Mill-Waukee-Mills of Standard Units: A milling machine of which the base, heads, columns, and other parts are built in standard units, thus enabling the user to order a machine that will be especially adapted for his job, is described and illustrated in Catalog No. 36, issued by the Kearney & Trecker Corporation, Milwaukee, Wis. Free to machine shop executives.

For Your Catalog Library

Threading Machinery: Complete catalogs of individual bulletins covering the pipe threading and cutting machines, bolt threading machines, or die heads made by Landis Machine Co., Waynesboro, Penna., may be had upon request from this firm. State size and type of machine or die head concerning which information is required.

Air-Operated Work-Holding Devices: A booklet showing how air-operated chucks and devices of various kinds can be applied to different kinds of machines to save time and labor has been issued by The Logansport Machine Co., Logansport, Ind.

Save Your Diamonds by using the Diamond Point Angle Tool. Write for information to Mendes Cutting Factories, Inc., Charlevoix Bldg., Detroit, Mich., or 105 West 40th Street, New York, N. Y.

Monarch Toolroom Lathes: Catalog "C," issued by The Monarch Machine Tool Co., Sidney, Ohio, describes and illustrates the line of toolroom lathes made by this firm. Copy free on request.

Compound Spot-Facing Tool: A spot-facing tool retracting, serrated roughing cutters and fixed finishing cutters in the same tool will break up the scale easily and do accurate work. Write for bulletin to Mummert-Dixon Co., 120 Philadelphia St., Hanover, Penna.

Ball and Roller Bearing Data Sheets: A complete set of data sheets showing all the dimensions and loads at given speeds, and giving instructions for mounting precision ball bearing and Hoffmann roller bearings, can be obtained without charge by addressing the Norma-Hoffmann Bearings Corporation, Stamford, Conn.

"Commercial Lapping for Close Limits and High Production" is the title of a booklet that discusses hand and machine lapping, types of lapping tools and machines, workholders for machines, preparation of laps, preparation of work for lapping and other important points. A copy may be had by addressing Norton Company, Worcester, Mass.

Die Making Machines: How dies, templates, gages, etc., can be sawed out, filed, and lapped easily and accurately on Oliver die making machines is fully described in a bulletin issued by the Oliver Instrument Company, 1430 Maumee Street, Adrian, Mich. Mailed upon request.

Good Gears of all kinds—spur, spiral, bevel, worm, hypoid—in fact, any kind or type of gear desired, large or small, machined to an excellent finish and the highest degree of accuracy, may be obtained from Perkins Machine & Gear Co., 151 Circuit Ave., Springfield, Mass. Write for estimates.

Bench Lathe Mounting and Driving Equipment: Bulletin 120-A, issued by Rivett Lathes and Grinder Corporation, Brighton, Mass., contains complete descriptions and illustrations of modern and conventional countershaft, individual motor drive jackshaft, and speed box motor drive, also benches, cabinets, oil pans, etc. Copy free upon request.

Pellmore Industrial Clutch: A multiple disc clutch, made in two types, to run in oil or dry, and which is so built that it can be operated at high speeds, is illustrated and described in a folder that will be sent free by the Rockford Drilling Machine Company, Rockford, Ill.

Automatic Lubrication: Individually motor-driven pumps that keep the work flooded with lubricant are described

in a booklet that has been published by the Ruthman Machinery Co., Front and Pike Sts., Cincinnati, Ohio.

Steel Stamps and Marking Dies: Full information as to steel stamps, steel roller dies, embossing dies, and embossing rolls made by the Schwerdtle Stamp Co., 10 Cannon Street, Bridgeport, Conn., can be had by writing this firm.

The Most Efficient Speed for the operation of special production units, power conveyors, and other machinery by the use of the WHS Speed Reducer and how it can be obtained is told in a bulletin that will be mailed free by Winfield H. Smith, Inc., 30 Eaton St., Springfield, N. Y.

Speed and Accuracy in Straightening: The Springfield Straightening Press is an ideal tool for use in straightening any length or size of rough or finished work. Send for illustrated folder. Address The Springfield Machine Tool Co., 630 West Southern Avenue, Springfield, Ohio.

"Stark" Motor Drive Unit: A motor drive unit for use with bench lathes, bench millers, and other machines operating on $\frac{1}{2}$ h.p. with a variable speed reduction gear is described in Bulletin "F," issued by Stark Tool Co., Waltham, Mass. Copy free upon request.

Cutting and Grinding Facts: A discussion of cutting oils and lubricants, together with descriptions and illustrations of various kinds of jobs upon which cutting oils are used, is contained in a booklet that is issued by the Sun Oil Company, 1608 Walnut Street, Philadelphia, Penna. Free upon request.

Tips for Torches: Standardized cutting and welding tips that are interchangeable with various types of torches are now available. Write for catalog to Tips, Inc., 515 Cathedral Street, Baltimore, Md.

Check With Air: How time and labor can be saved by the use of air-operated chucks, cylinders, and other equipment is told in a book which describes "Hopkins" Air-Operated Equipment. Published by The Tomkins-Johnson Company, 620 N. Mechanic St., Jackson, Mich. Sent free upon request.

Change drilling speeds instantly without stopping the machine or touching a belt. This can be done with the Victor Super-Drill, made by U. S. Automatic Box Machinery Co., Newtonville, Boston, Mass. Bulletin free upon request.

Electrically-Driven Portable Tools: The "U. S." line of electric drills, die grinders, surface grinders, tool-post grinders, and bench and floor grinders is described in Catalog No. 33, published by The United States Electrical Tool Co., 2471 West Sixth Street, Cincinnati, Ohio. Copy free.

Double-Life End Mills: Weldon Double-End Type End Mills, made with blades on each end, are described in Catalog No. 6, issued by The Weldon Tool Company, 1426 West Third Street, Cleveland, Ohio. Other small tools made by this firm are also described and illustrated in this catalog.

Shop Furniture: A catalog describing and illustrating all kinds of shop furniture, including benches, vices, steel stands, foremen's desks, chip trucks, steel racks for bar stock, steel tote boxes, and other equipment will be sent free upon application to The Western Tool & Manufacturing Co., 1620 East Pleasant Street, Springfield, Ohio.

(Continued from page 51)

ends all one way, and an agitating device in the bottom of the magazine prevents jamming. The magazine can also be used for small steel parts.

Wel-Don "Extra Long" End Mill

The Weldon Tool Co., 1426 West Third Street, Cleveland, Ohio, is manufactur-



Wel-Don "Extra Long" End Mill

ing an "extra long" type of end mill, especially designed for milling deep pockets in dies and other similar work. The mill is made of high speed steel, in right or left hand spiral, and right or left hand cut. In order to assure stiffness and absence of chattering under heavy feeds and high speeds, from 4 to 8 hollow-ground flutes are used, the number of flutes depending on the size of the mill. Shanks are made either standard taper or straight with an extra flat on the larger sizes so that they can be used with the Wel-Don pin-drive holders.

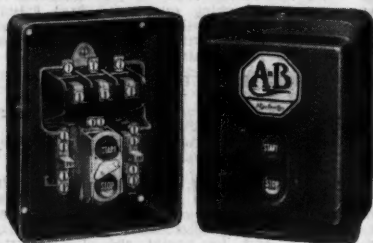
Allen-Bradley Bulletin 609 Hand-Operated A. C. Starting Switch

A compact manually-operated switch that will start and stop small A. C. motors and give overload protection has been developed by the Allen-Bradley Company, 1313 S. First Street, Milwaukee, Wis. The switch has two overload relays, the tripping of either relay open-

ing the contactor and completely disconnecting the motor from the line. Either relay, after tripping, can be reset without opening the switch cabinet. The switch is opened and closed by buttons that extend through the cabinet cover.

The Bulletin 609 switch consists of five parts; a terminal block, a movable contactor arm, the operating button mechanism, and the two overload relays.

Pushing in the "Start" button moves the contactor arm upward with a quick snap, causing it to contact with the overhead terminal block and connect the motor to the supply line. The tripping of either overload relay disengages the contactor arm from the "Start" button and forces the contacts apart by spring pressure. The "Stop" button is also the reset button for the relay; pushing it in resets the tripped relay and re-engages the contactor arm with the "Start" button so that the



Allen-Bradley Bulletin 609 Hand-Operated A. C. Starting Switch

switch can be closed by pushing the "Start" button.

The switch is made in two sizes, to handle all the sizes of motors commonly used for industrial purposes.



Manual

SPEED SPOT WELDERS

OVER 20,000 IN USE

Made foot-operated and automatic motor drive. For welding from .0005" to 1/8" combined thickness.

Welders for fine work priced as low as.....

\$55.00

SUBMIT YOUR PROBLEMS

EISLER ELECTRIC

761 South 13th Street

NEWARK, NEW JERSEY

Distributor and Dealer Connections Desired



Automatic

1/2 to 50
K. V. A.

WEL-DON END MILLS

For Fast Keyway Milling →

HIGHEST SPEEDS FASTEST FEEDS

Drills as well as Mills. No Center Hole on end.

Double Cutting Edge Back-off keeps size right longer.

Double-Ended



Hollow Ground Flutes permit unbelievably large cuts easily.

Parallel shank design, with Wel-Don tool holder, permits mill change in less than 40 seconds.

Stocks in All Principal Cities

The WELDON TOOL CO., 1426 W. 3rd St., Cleveland, Ohio



TO CHECK HARDNESS

You just set the DUROSKOP against the test piece—press a button—and read the scale. The instrument gives consistent readings on almost any material—and it weighs less than a pound.

Complete Details in
Pamphlet H-4

THE R. Y. FERNER CO.

1131 Investment Bldg., Washington, D. C.

Tool Holders that are THOROUGHLY DEPENDABLE



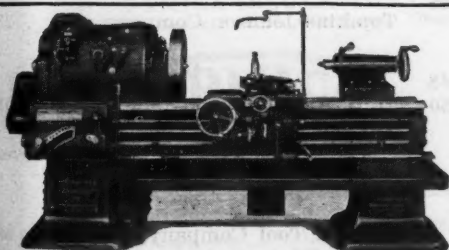
WESTERN TOOL HOLDERS meet the exacting requirements of machinists everywhere. They are made from thoroughly case hardened drop forgings to provide maximum strength.

Note the design which gives maximum support to the tool. Mac-it set screws used. Holders equipped with best high speed steel cutters.

Use Western Tool Holders—then compare results.

Prices Sent on Request

THE WESTERN TOOL & MFG. CO.
SPRINGFIELD, OHIO



A Safe Bet!

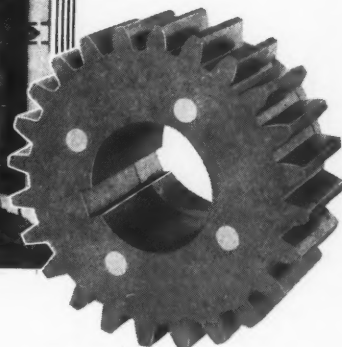
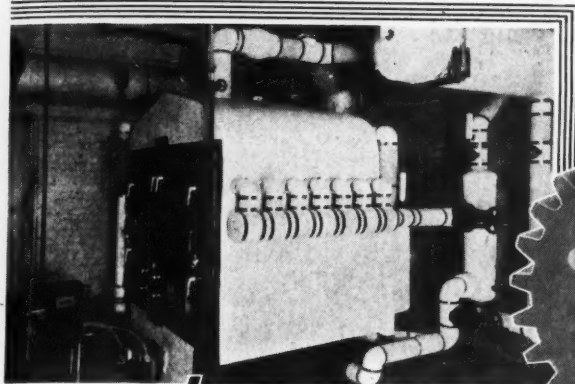
When you want a lathe that will increase your production and cut your costs... specify a **SPRINGFIELD Precision TOOL ROOM LATHE**. Past performances prove that it is a Safe Bet!

The Springfield Machine Tool Co., 630 West Southern Ave., Springfield, Ohio

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FORMICA GEARS



silence this Oil Burner

ELECTROL, Inc. St. Louis, has found, like other manufacturers of machinery for the home, the office and the store, that Formica gears greatly reduce the sound made by their equipment in operating—and is therefore a most important selling point.

Maintenance men everywhere use Formica for the same reason. Quiet machinery sounds well-taken-care-of. It helps them with their work.

The gear cutters named on this page can give prompt service on one or many gears.

THE FORMICA INSULATION CO.
4632 Spring Grove Avenue, Cincinnati, Ohio

FORMICA
Non-Metallic
GEARS

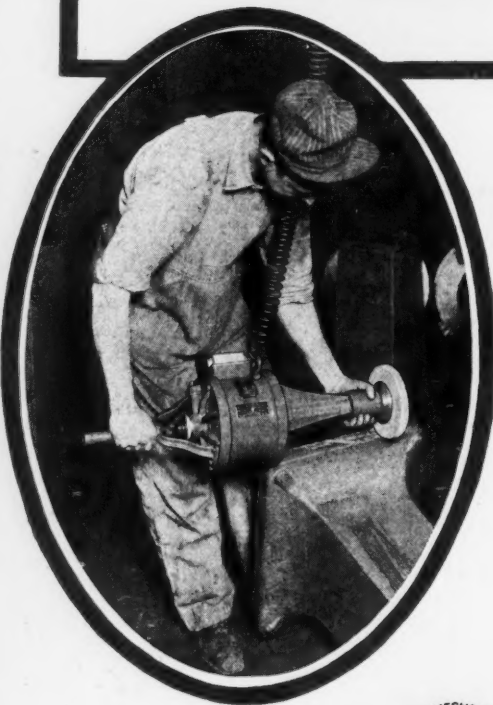
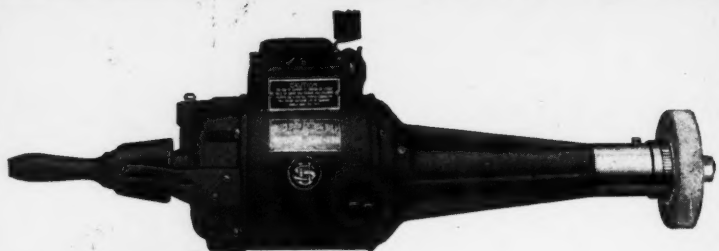
FORMICA GEAR CUTTERS

The Akron Gear & En'g Co., Akron, Ohio	Mobile Pulley & Machine Mobile, Ala.
Farrell-Birmingham Co., Inc., Buffalo, N. Y.	Berkley Machine Works & Foundry Co. Norfolk, Va.
Slaysman & Company Baltimore, Md.	Empire Machinery & Supply Corp., Norfolk, Va.
Harry A. Moore Bangor, Me.	Meisselbach Catucci Mfg. Co., Newark, N. J.
The Union Gear & Mch. Co., Boston, Mass.	Sier-Bath, Inc. New York City, N. Y.
The Atlantic Gear Works, Brooklyn, N. Y.	E. M. Smith Machine Shop, Peoria, Ill.
Chicago Rawhide Mfg. Co., Chicago, Ill.	The Earle Gear & Mch. Co., Philadelphia, Pa.
Perfection Gear Company Chicago, Ill.	Rodney Davis and Sons Philadelphia, Pa.
Chicago Gear Company Chicago, Ill.	Lamont Gear & Mch. Co. Philadelphia, Pa.
The Cincinnati Gear Co. Cincinnati, O.	The Pittsburgh Machine & Supply Co. Pittsburgh, Pa.
The Clarksville Foundry and Machine Co. Clarksville, Tenn.	Standard Gear Co. Pittsburgh, Pa.
The Horsburgh & Scott Co., Cleveland, O.	The Turley Gear & Mch. Co., St. Louis, Mo.
The Stahl Gear & Machine Co., Cleveland, O.	Perkins Machine & Gear Co., Springfield, Mass.
Robinson Machine & Forge Co., Dallas, Tex.	Winfield H. Smith, Inc., Springfield, N. Y.
The Master Electric Co. Dayton, O.	Alling Lander Company Sodus, N. Y.
The Adams Company Dubuque, Ia.	Charles E. Crofoot Gear Corp'n South Easton, Mass.
Hammer Machine Works Fort Smith, Arkansas	Arlington Machine Co. St. Paul, Minn.
Austin Machine Co. Fort Worth, Tex.	Dieffendorf Gear Corp. Syracuse, N. Y.
The Ferguson Gear Co. Gastonia, N. C.	Farwell Mfg. Co. Toledo, O.
Hartford Special Mch'ny. Co., Hartford, Conn.	Worcester Gear Works Worcester, Mass.
H. C. Brelle Milwaukee, Wis.	Massachusetts Gear & Tool Co., Woburn, Mass.
The E. A. Pynch-Co. Minneapolis, Minn.	

Precision Machine Co.
Milwaukee, Wis.
Joaquín Alemany López
Havana, Cuba

The Dedman Foundry & Mach. Co., Houston, Tex.
The Generating Gear Co.
Milwaukee, Wis.

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A lot of people have daily grinds which are considered unpleasant!

But here's one grind that every good mechanic likes! It's the steady, reliable and accurate grind produced by the U. S. Portable Surface Grinder.

In the foundry, you find it used for sanding down castings . . . At the arc welder's bench for dressing off gas welds . . . In railroad shops, drop forging plants and locomotive works—and numerous other shops where husky grinding jobs are required — U. S. Grinders are steadily used for all kinds of surfacing work.

If you use a grinder in your shop, you should get a copy of the new U. S. Catalog No. 33, which gives complete information and specifications on this sturdy machine.



THE UNITED STATES ELECTRICAL TOOL COMPANY

DRILLS - GRINDERS - BUFFERS

2471 WEST SIXTH STREET

Dept. I

CINCINNATI, OHIO